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Department of Energy
FY 2011 Congressional
Budget Request

Science

February 2010 Office of Chief Financial Officer Volume 4

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Volume 4

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The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

For the latest details on the Department of Energy's implementation of the Recovery Act, please visit: http://www.energy.gov/recovery

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2009 Current Approp.	FY 2009 Current Recovery	FY 2010 Current Approp.	FY 2011 Congressional Request	FY 2011 vs. FY 2010	
					$	%
Discretionary Summary By Appropriation						
Energy And Water Development, And Related Agencies						
Appropriation Summary:						
Energy Programs						
Energy efficiency and renewable energy	2,156,865	16,771,907	2,242,500	2,355,473	+112,973	+5.0%
Electricity delivery and energy reliability	134,629	4,495,712	171,982	185,930	+13,948	+8.1%
Nuclear energy	791,444	0	786,637	824,052	+37,415	+4.8%
Fossil energy programs						
Clean coal technology	0	0	0	0	—	—
Fossil energy research and development	863,104	3,398,607	672,383	586,583	-85,800	-12.8%
Naval petroleum and oil shale reserves	19,099	0	23,627	23,614	-13	-0.1%
Strategic petroleum reserve	226,586	0	243,823	138,861	-104,962	-43.0%
Strategic petroleum account	-21,586	0	0	0	—	—
Northeast home heating oil reserve	9,800	0	11,300	11,300	—	—
Total, Fossil energy programs	1,097,003	3,398,607	951,133	760,358	-190,775	-20.1%
Uranium enrichment D&D fund	535,503	390,000	573,850	708,498	+134,648	+23.5%
Energy information administration	110,595	0	110,595	128,833	+18,238	+16.5%
Non-Defense environmental cleanup	261,819	483,000	254,673	225,163	-29,510	-11.6%
Science	4,813,470	1,632,918	4,903,710	5,121,437	+217,727	+4.4%
Energy transformation acceleration fund	8,700	388,856	0	299,966	+299,966	N/A
Nuclear waste disposal	145,390	0	98,400	0	-98,400	-100.0%
Departmental administration	155,326	42,000	168,944	169,132	+188	+0.1%
Inspector general	51,927	15,000	51,927	42,850	-9,077	-17.5%
Advanced technology vehicles manufacturing loan	7,510,000	10,000	20,000	9,998	-10,002	-50.0%
Innovative technology loan guarantee program	0	0	0	500,000	+500,000	N/A
Section 1705 temporary loan guarantee program	0	3,960,000	0	0	—	—
Total, Energy Programs	17,772,671	31,588,000	10,334,351	11,331,690	+997,339	+9.7%
Atomic Energy Defense Activities						
National nuclear security administration:						
Weapons activities	6,410,000	0	6,384,431	7,008,835	+624,404	+9.8%
Defense nuclear nonproliferation	1,545,071	0	2,136,709	2,687,167	+550,458	+25.8%
Naval reactors	828,054	0	945,133	1,070,486	+125,353	+13.3%
Office of the administrator	439,190	0	410,754	448,267	+37,513	+9.1%
Total, National nuclear security administration	9,222,315	0	9,877,027	11,214,755	+1,337,728	+13.5%
Environmental and other defense activities:						
Defense environmental cleanup	5,656,345	5,127,000	5,642,331	5,563,039	-79,292	-1.4%
Other defense activities						
Health, safety and security	446,471	0	441,882	464,211	+22,329	+5.1%
Legacy Management	185,981	0	189,802	188,626	-1,176	-0.6%
Nuclear energy	565,819	0	83,358	88,200	+4,842	+5.8%
Defense related administrative support	108,190	0	122,982	130,728	+7,746	+6.3%
Office of hearings and appeals	6,603	0	6,444	6,444	—	—
Congressionally directed projects	999	0	3,000	0	-3,000	-100.0%
Total, Other defense activities	1,314,063	0	847,468	878,209	+30,741	+3.6%
Defense nuclear waste disposal	143,000	0	98,400	0	-98,400	-100.0%
Total, Environmental & other defense activities	7,113,408	5,127,000	6,588,199	6,441,248	-146,951	-2.2%
Total, Atomic Energy Defense Activities	16,335,723	5,127,000	16,465,226	17,656,003	+1,190,777	+7.2%
Power marketing administrations:						
Southeastern power administration	7,420	0	0	0	—	—
Southwestern power administration	28,414	0	13,076	12,699	-377	-2.9%
Western area power administration	218,346	10,000	109,181	105,558	-3,623	-3.3%
Falcon & Amistad operating & maintenance fund	2,959	0	220	220	—	—
Colorado River Basins	-23,000	0	-23,000	-23,000	—	—
Total, Power marketing administrations	234,139	10,000	99,477	95,477	-4,000	-4.0%
Federal energy regulatory commission	0	0	0	0	—	—
Subtotal, Energy And Water Development and Related Agencies	34,342,533	36,725,000	26,899,054	29,083,170	+2,184,116	+8.1%
Uranium enrichment D&D fund discretionary payments	-463,000	0	-463,000	-696,700	-233,700	-50.5%
Excess fees and recoveries, FERC	-23,080	0	-28,886	-29,822	-936	-3.2%
Cost of implementing reclassification of receipts, PMAs	0	0	189,384	0	-189,384	-100.0%
Total, Discretionary Funding	**33,856,453**	**36,725,000**	**26,596,552**	**28,356,648**	**+1,760,096**	**+6.6%**

Science

Proposed Appropriation Language

For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for science activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or facility or for plant or facility acquisition, construction, or expansion, and purchase of not more than [50] *57* passenger motor vehicles, 56 *of which are* for replacement only, including [one] *two* law enforcement [vehicle] *vehicles*, two ambulances, and [three] *two* buses, [$4,903,710,000] *$5,121,437, 000*, to remain available until expended[: Provided, That $15,000,000 appropriated under this heading under prior appropriation Acts for the Advanced Research Projects Agency—Energy is hereby transferred to the "Advanced Research Projects Agency—Energy" account: Provided further, That, of the amount appropriated in this paragraph, $76,890,000 shall be used for the projects specified in the table that appears under the heading "Congressionally Directed Science Projects" in the joint explanatory statement accompanying the conference report on this Act]. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

Explanation of Change

Changes are proposed to reflect the FY 2011 funding and vehicle request.

Office of Science

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Office of Science				
Advanced Scientific Computing Research	358,772	+161,795	394,000	426,000
Basic Energy Sciences	1,535,765	+555,406	1,636,500	1,835,000
Biological and Environmental Research	585,176	+165,653	604,182	626,900
Fusion Energy Sciences	394,518	+91,023	426,000	380,000
High Energy Physics	775,868	+232,390	810,483	829,000
Nuclear Physics	500,307	+154,800	535,000	562,000
Workforce Development for Teachers and Scientists	13,583	+12,500	20,678	35,600
Science Laboratories Infrastructure	145,380	+198,114	127,600	126,000
Safeguards and Security	80,603	0	83,000	86,500
Science Program Direction	186,695	+5,600	189,377	214,437
Small Business Innovation Research (SBIR)/ Small Business Technology Transfer (STTR) (SC funding)	104,905[b]	+18,719[b]	0	0
Subtotal, Office of Science	4,681,572	+1,596,000[c]	4,826,820	5,121,437
Congressionally-directed projects	91,064	0	76,890	0
SBIR/STTR (Other DOE funding)	49,534[d]	+36,918[d]	0	0
Subtotal, Office of Science	4,822,170	+1,632,918	4,903,710	5,121,437
Use of prior year balances	-15,000	0	0	0
Total, Office of Science	4,807,170	+1,632,918	4,903,710	5,121,437
Advanced Research Projects Agency-Energy (ARPA-E)	6,300[e]	0	0	0
Total, Science Appropriation	4,813,470	+1,632,918	4,903,710	5,121,437

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009 from the American Recovery and Reinvestment Act of 2009, P.L. 111–5. See the Department of Energy Recovery website at http://www.energy.gov/recovery for up-to-date information regarding Recovery Act funding.

[b] Reflects funding reprogrammed within the Science total to support the SBIR and STTR programs.

[c] $4,000,000 of the original $1,600,000,000 Recovery Act appropriation has been transferred to Departmental Administration for management and oversight.

[d] Reflects funding transferred from other DOE appropriation accounts to support the SBIR and STTR programs.

[e] $15,000,000 was appropriated in FY 2009 in the Science account for ARPA-E. The FY 2010 appropriation directed that this $15,000,000 be transferred to the Energy Transformation Acceleration Fund (ARPA-E). $8,700,000 has been transferred to date. Remaining balances of $6,300,000 will also be transferred during FY 2010.

Preface

The Office of Science request for Fiscal Year (FY) 2011 is $5,121,437,000, an increase of $217,727,000, or 4.4%, over the FY 2010 appropriation; and is $294,617,000, or 6.1%, over the FY 2010 appropriation excluding congressionally-directed projects.

Fundamentally new approaches to technologies for energy production, storage, and use are essential. To accomplish this will require sustained investments in exploratory and high-risk research in traditional and emerging disciplines, including the development of new tools and facilities; focused investments in high-priority research areas; and investments that train new generations of scientists and engineers to be leaders in the 21st century.

The FY 2011 budget request supports the President's Plan for Science and Innovation, which encompasses the entire Office of Science budget, as part of a strategy to double overall basic research funding at select agencies. As part of this plan, the FY 2011 request supports the training of students and researchers in fields critical to our national competitiveness and innovation economy, and supports investments in areas of research critical to our clean energy future and to making the U.S. a leader on climate change. The FY 2011 request also supports the President's priorities for the U.S. Global Change Research Program, the National Nanotechnology Initiative, and Networking and Information Technology Research and Development.

The Office of Science supports research programs in condensed matter and materials physics, chemistry, biology, climate and environmental sciences, applied mathematics, computational science, high energy physics, nuclear physics, plasma physics, and fusion energy sciences. The Office of Science also provides the Nation's researchers with state-of-the-art user facilities—the large machines of modern science. Increasingly, they are first-of-a-kind facilities, and they are in the billion-dollar-class range. These facilities offer capabilities that are unmatched anywhere in the world and enable U.S. researchers and industries to remain at the forefront of science, technology, and innovation. They include electron and proton accelerators and colliders for probing matter on scales from the subatomic to the macroscopic, the world's forefront neutron scattering facility and the world's best suite of synchrotron light sources for probing the structure and function of materials, and the world's largest and fastest computational resources devoted to the most challenging societal problems of our time. These facilities also include technologically advanced, large-scale field sites for investigating the effects of clouds on atmospheric radiation, comprehensively equipped nanoscience and molecular science centers, facilities for rapid genome sequencing and integrated environmental molecular sciences, and facilities for investigating the plasma state and its properties for stable fusion systems.

The Office of Science supports investigators from more than 300 academic institutions and from all of the DOE laboratories. The FY 2011 budget request will support about 27,000 Ph.D.'s, graduate students, undergraduates, engineers, and technicians. Nearly 26,000 researchers from universities, national laboratories, industry, and international partners are expected to use the Office of Science scientific user facilities in FY 2011.

The Office of Science is responsible for the oversight of ten of the DOE national laboratories: Ames National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Laboratory.

The Office of Science has ten programs: Advanced Scientific Computing Research (ASCR), Biological and Environmental Research (BER), Basic Energy Sciences (BES), Fusion Energy Sciences (FES), High Energy Physics (HEP), Nuclear Physics (NP), Workforce Development for Teachers and Scientists

(WDTS), Science Laboratories Infrastructure (SLI), Safeguards and Security (S&S), and Science Program Direction (SCPD).

Mission

The mission of the Office of Science is the delivery of scientific discoveries and major scientific tools to transform our understanding of nature and to advance the energy, economic, and national security of the United States.

Benefits

The Office of Science accomplishes its mission by supporting:

- *Science for Discovery* focused on unraveling nature's mysteries—from the study of subatomic particles, atoms, and molecules that make of the materials of our everyday world to DNA, proteins, cells, and entire biological systems;
- *Science for National Need* focused on advancing a clean energy agenda through basic research on energy production, storage, transmission, and use; and advancing our understanding of the Earth's climate through basic research in atmospheric and environmental sciences and climate change; and
- *National Scientific User Facilities*, the 21st century tools of science, engineering, and technology—providing the Nation's researchers with the most advanced tools of modern science including accelerators, colliders, supercomputers, light sources and neutron sources, and facilities for studying the nanoworld.

Performance

The Office of Science activities target the Secretary's Innovation goal (*Lead the world in science, technology, and engineering*), and those activities underlie progress on the Secretary's Energy goal (*Build a competitive, low-carbon economy and secure America's energy future*) and Security goal (*Reduce nuclear dangers and environmental risks*). Each of the Office of Science research programs support fundamental, innovative, peer-reviewed research to create new knowledge in areas important to Office of Science and program missions, and support the design, construction, and operation of a wide array of scientific user facilities essential for advancing the frontiers of research in relevant areas of science and technology and providing the Nation scientific tools to remain at the forefront of innovation and competitiveness.

Program Overview

The *Advanced Scientific Computing Research* program supports research to discover, develop, and deploy the computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to DOE. Scientific computing is particularly important for the solution of research problems that are unsolvable through traditional theoretical and experimental approaches or are too hazardous, time-consuming, or expensive to solve by traditional means. ASCR supports research in applied mathematics, computer science, advanced networking, and computational partnerships (Scientific Discovery through Advanced Computing, or SciDAC); research and evaluation prototypes; and the operation of high performance computing systems and networks. In FY 2011, ASCR continues research efforts in the SciDAC, applied mathematics, and computer science programs. The FY 2011 request supports continued operations of the Leadership Computing Facilities at the Oak Ridge and Argonne National Laboratories, and the operations of the National Energy Research Scientific Computing (NERSC) facility, which reaches approximately one petaflop capacity in FY 2010, at Lawrence Berkeley National Laboratory. The Energy Sciences network (ESnet) will deliver 100–400 gigabit per second connections among the Office of Science laboratories in FY 2011.

The *Basic Energy Sciences* program supports research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels. BES-supported research disciplines—condensed matter and materials physics, chemistry, geosciences, and aspects of physical biosciences—provide the knowledge base for the control of the physical and chemical transformations of materials and the discovery and design of new materials with novel structures, functions, and properties. These disciplines drive new solutions and technologies in virtually every aspect of energy resources, production, conversion, transmission, storage, and efficiency. BES also plans, designs, constructs, and operates scientific user facilities that use x-ray, neutron, and electron beam scattering to probe the most fundamental electronic and atomic properties of materials at extreme limits of time, space, and energy resolution. The world-class scientific user facilities supported by BES provide important capabilities for fabricating, characterizing, and transforming materials of all kinds from metals, alloys, and ceramics to fragile bio-inspired and biological materials. In FY 2011, investments continue to support the Energy Frontier Research Centers (EFRCs), focused on accelerating fundamental energy sciences, as well as single investigator and small group awards. BES also takes part in the Department's multi-disciplinary Energy Innovation Hubs program. In FY 2011, BES-supported Hubs will focus on Fuels from Sunlight and Batteries and Energy Storage, and BES will support additional EFRCs focused on discovery and development of new materials and energy applications in areas such as carbon capture and advanced nuclear energy systems.

The *Biological and Environmental Research* program supports research to explore the frontiers of genome-enabled biology; discover the physical, chemical, and biological drivers of climate change; and seek the molecular determinants of environmental sustainability and stewardship. BER-supported systems biology research uncovers Nature's secrets from the diversity of microbes and plants to understand how biological systems work, how they interact with each other, and how they can be manipulated to harness their processes and products to contribute to new strategies for producing new biofuels, cleaning up legacy waste, and sequestering carbon dioxide (CO_2). BER plays a vital role in supporting research on atmospheric processes, climate modeling, interactions between ecosystems and greenhouse gases (especially CO_2), and analysis of impacts of climatic change on energy production and use. Subsurface biogeochemistry research seeks to understand the role that subsurface biogeochemical processes play in determining the fate and transport of contaminants including heavy metals and radionuclides. In FY 2011, BER continues research in systems biology, radiochemistry, climate science, and subsurface biogeochemistry. Support is provided for the three Bioenergy Research Centers, the Joint Genome Institute, and the Environmental Molecular Sciences Laboratory. The FY 2011 request includes investment in climate science research to more rapidly integrate existing and new knowledge into next-generation climate and Earth system prediction models that systematically reduce the uncertainties in predictions of decade to century climate change and increase the availability and usability of climate predictions to address the critical DOE mission to provide energy security to the Nation in a sustainable way. BER will also continue support for simulations and analyses needed for part of the Intergovernmental Panel on Climate Change Fifth Assessment.

The *Fusion Energy Sciences* program supports research to expand the fundamental understanding of matter at very high temperatures and densities and the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas under a wide range of temperature and density, developing advanced diagnostics to make detailed measurements of their properties, and creating theoretical/computational models to resolve the essential physics. FES operates scientific user facilities to enable world-leading research programs in high-temperature, magnetically confined plasmas, and leads the U.S. participation in the design and construction of ITER, the world's first facility for studying a sustained burning plasma. FES also supports enabling R&D to improve the components and systems that are used to build fusion facilities. The FY 2011 budget request funds the U.S. Contributions to ITER project, including research and development of key components, long-lead procurements, personnel, and cash contribution to the ITER Organization. Research at the major experimental facilities in the FES program—the DIII-D tokamak, the Alcator C-Mod tokamak, and the National Spherical Torus Experiment—will continue to focus on providing solutions to high-priority technical issues and build a firm physics basis for ITER design and operation. Support for the Fusion Simulation Program computational initiative ramps up in FY 2011 as the program transitions from its planning phase to the full program. FES also continues to support the joint program in high energy density laboratory plasmas with the National Nuclear Security Administration.

The *High Energy Physics* program supports research to understand how the universe works at its most fundamental level. This is accomplished by discovering the most elementary constituents of matter and energy, probing the interactions among them, and exploring the basic nature of space and time itself. Research includes theoretical and experimental studies by individual investigators and large collaborative teams: some who gather and analyze data from accelerator facilities in the U.S. and around the world and others who develop and deploy ultra-sensitive ground- and space-based instruments to detect particles from space and observe astrophysical phenomena. The Tevatron Collider at Fermi National Accelerator Laboratory continues operations during FY 2011. Support for Large Hadron Collider (LHC) detector operations, maintenance, computing, and R&D continues in FY 2011 in order to maintain a U.S. leadership role in the LHC program. Construction continues for the Neutrinos at the Main Injector (NuMI) Off-Axis Neutrino Appearance (NOvA) project to enable key measurements of neutrino properties. Project engineering and design begins for two new experiments using the NuMI beam and other auxiliary beamlines: the Long Baseline Neutrino Experiment (LBNE) and the Muon to Electron (Mu2e) experiment. Several projects to pursue questions in dark matter, dark energy, and neutrino properties continue in FY 2011, including the Cryogenic Dark Matter Search at the Soudan Mine in Minnesota, the Dark Energy Survey experiment in Chile, and R&D for the Joint Dark Energy Mission and for experiments that may be located in the National Science Foundation's proposed Deep Underground Science and Engineering Laboratory (DUSEL). HEP also continues support for advanced accelerator and detector R&D.

The *Nuclear Physics* program supports research to discover, explore, and understand all forms of nuclear matter. The fundamental particles that compose nuclear matter, quarks and gluons, are relatively well understood, but exactly how they fit together and interact to create different types of matter in the universe is still largely not understood. To accomplish this, NP supports experimental and theoretical research to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer found naturally. NP also provides stewardship of isotope production and technologies to advance important applications, research, and tools for that nation. The FY 2011 request supports near optimal levels of operations at the four NP scientific user facilities: the Continuous Electron Beam Accelerator Facility (CEBAF), the Relativistic Heavy Ion Collider (RHIC), the Argonne Tandem Linac Accelerator System (ATLAS), and the Holifield Radioactive Ion Beam Facility (HRIBF). Construction for the 12 GeV CEBAF Upgrade project continues as do activities for the proposed Facility for Rare Isotope Beams (FRIB). The request also supports several ongoing major items of equipment to address compelling scientific opportunities. In FY 2011, the Isotope Development and Production for Research Applications Program will focus on production of isotope needed by stakeholders and research isotope priorities identified by the Nuclear Science Advisory Committee and community input.

The *Workforce Development for Teachers and Scientists* program supports a range of activities for science, technology, engineering, and mathematics (STEM) students and educators, including the DOE Office of Science Graduate Fellowship program, undergraduate research programs that place students in world class research environments at the DOE laboratories, mentorship programs for K–12 teachers and undergraduate faculty who teach STEM subjects, and nation-wide competitions at the middle school and high school levels, such as the National Science Bowl®. In FY 2011, the Office of Science will initiate a research program to assess the effectiveness of investments in science, consistent with the federal interagency Science of Science Policy initiative.

Office of Science Early Career Research Program

In July 2009, the Office of Science announced the establishment of the Office of Science Early Career Research Program to support outstanding scientists early in their careers in the disciplines supported by the Office of Science. This program provides competitively selected 5-year research awards to researchers who have received a Ph.D. within the past ten years and who are untenured, tenure-track assistant professors in U.S. academic institutions or full-time employees in DOE national laboratories. Early career researchers may apply to any of the Office of Science research programs. Proposed research topics must fall within the Office of Science programmatic priorities, which are provided in annual program announcements. This program addresses recommendations from multiple Committee of Visitors' reviews and reports such as the National Academies' 2005 study, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*.

FY 2010 is the first year of this program with support for approximately 65 research awards provided through Recovery Act funds. Proposals, which will be merit reviewed by external panels of experts, were due September 1, 2009, and awards are expected to be announced by May 2010. Beginning in FY 2011, the Office of Science will issue an annual solicitation, and the Office of Science research programs will support awards through annual appropriated funds. Approximately 60 new research awards to university and DOE laboratory researchers are expected to be awarded in FY 2011 based on this open, competitive process. Office of Science program offices with existing early career research award programs, such as the Outstanding Junior Investigator awards programs, will gradually integrate these programs into the Office of Science Early Career Research Program.

Isotope Development, Production, and Research

Isotope production at the Department of Energy is primarily the responsibility of the Office of Science with two exceptions: plutonium-238 production by the Office of Nuclear Energy (NE) and molybdenum-99 production supported by NNSA's Global Threat Reduction Initiative (GTRI).

The Isotope Development and Production for Research and Applications (Isotope) program located in SC's Nuclear Physics program offers more than 120 stable and radioactive isotopes for use in basic research and in medical diagnostic, medical treatment, national security, energy, and industrial applications. The Isotope program produces isotopes only where there is no U.S. private sector capability or where other production capacity is insufficient to meet U.S. needs. Isotope production for commercial use or repackaging is on a full-cost recovery basis, while isotopes produced solely for non-proprietary research purposes are provided at below cost. The Isotope program works in close collaboration with other federal agencies and the isotope-using communities to develop priorities for production. This past year, the Nuclear Science Advisory Committee issued its report establishing priorities for the production of research isotopes in April 2009. A long-term strategic plan for the program came out in November 2009. Both reports were developed with federal, commercial, and research community input. A current priority is the production of helium-3, used in neutron detection and cryogenics. Historically, helium-3 has been a by-product of tritium production for the U.S. weapons program. With the reduction in nuclear weapons, tritium production is at a low level and current demand for helium-3 has drawn down supplies. U.S. and international efforts are underway to address the helium-3 supply shortfall.

For nearly 50 years, NE's Space and Defense Power Systems program has supported the design, development, production, and safety of plutonium-238 radioisotope power systems. Science missions to explore the solar system and other government applications use plutonium-238 power systems. With a limited existing plutonium-238 stockpile, NE is working to re-establish domestic plutonium-238 production in order to assure continued availability of these power systems.

Molybdenum-99, or moly-99, is widely used in medical diagnosis and has been produced commercially with reactors using highly enriched uranium (HEU) fuel. Because of the nonproliferation mission to remove HEU from use, NNSA's GTRI program has the lead for moly-99. As part of its nuclear nonproliferation mission, and in light of the current moly-99 supply shortage, GTRI is working to demonstrate moly-99 production without the use of HEU. GTRI is implementing projects to demonstrate the viability of non-HEU based technologies for large-scale commercial moly-99 production, including accelerator technology, low-enriched uranium (LEU) target technology, LEU solution reactor technology, and neutron capture technology.

High-Risk, High-Reward Research[a]

The Office of Science programs incorporate high-risk, high-reward research elements in all of its research portfolios. Because advancing the frontiers of science also depends on the continued availability of state-of-the-art scientific facilities, the Office of Science constructs and operates national scientific facilities and instruments that comprise the world's most sophisticated suite of research capabilities.

Effective program management is critical to the support of high-risk, high-reward research. The Office of Science program managers are experts in their respective fields and communicate program research priorities and interests to the scientific community; select proposal reviewers that are open to bold ideas; provide guidance to merit reviewers—including guidance on consideration of high-risk, high-reward research; and make recommendations on proposal selection, weighing inputs from peer review with programmatic relevance, potential impact, and overall portfolio balance. Committees of Visitors review program portfolios triennially to assess, among other things, the balance and impact of the portfolios, including an assessment of high-risk, high-reward research.

The fraction of high-risk, high-reward activities is not easy to quantify, because such research is integrated within program portfolios. However, several mechanisms are used to identify and develop "high-reward" research topics, including Federal advisory committees, program and topical workshops, interagency working groups, National Academy of Sciences studies, and special Office of Science program solicitations. These activities have identified opportunities for new, compelling research. As examples, some of these opportunities are captured in the following reports: *Isotopes for the Nation's Future—A Long Range Plan*, by NSAC (2009); *New Science for a Secure and Sustainable Energy Future*, by the Basic Energy Sciences Advisory Committee (2008); *Identifying Outstanding Grand Challenges in Climate Change Research* workshop report (2008); *U.S. Particle Physics: Scientific Opportunities, A Strategic Plan for the Next Ten Years*, by the High Energy Physics Advisory Panel; and *The Frontiers of Nuclear Science*, by NSAC (2007).

Basic and Applied R&D Coordination

Coordination between the Department's basic research and applied technology programs is a high priority for the Secretary of Energy. The Department has a responsibility to coordinate its basic and applied research programs to effectively integrate R&D by the science and technology communities (e.g., national laboratories, universities, and private companies) that support the DOE mission. Efforts have focused on improving communication and collaboration between federal program managers and increasing opportunities for collaborative efforts targeted at the interface of scientific research and technology development to ultimately accelerate DOE mission and national goals. Coordination between the basic and applied programs is also enhanced through joint programs, jointly-funded scientific facilities, and the program management activities of the DOE Small Business Innovation Research and Small Business Technology Transfer programs. Additionally, co-funding research activities and facilities at the DOE laboratories and funding mechanisms that encourage broad partnerships (e.g., Funding Opportunity Announcements) are also means by which the Department facilitates greater communication and research integration within the basic and applied research communities.

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[a] In compliance with reporting requirements in the America COMPETES Act (P.L. 110–69, section 1008).

American Recovery and Reinvestment Act

The Office of Science received $1,632,918,000 under the American Recovery and Reinvestment Act of 2009. The Office of Science based Recovery Act funding decisions on two of the primary goals articulated in the Recovery Act's statement of purpose: to provide investments needed to increase economic efficiency by spurring technological advances in science, and to preserve and create jobs and promote economic recovery. The Office of Science's Recovery Act projects have the characteristics of being "shovel-ready," enhancing research infrastructure, supporting high-priority R&D, and minimizing outyear mortgages. Recovery Act projects include acceleration of ongoing line-item construction projects, acceleration of major items of equipment, upgrades to Office of Science scientific user facilities, laboratory general plant projects, and scientific research. More information on Office of Science Recovery Act supported activities can be found at the Department of Energy Recovery Act website (http://www.energy.gov/recovery/).

Energy Innovation Hubs

The Office of Science takes part in the Department's multi-disciplinary Energy Innovation Hubs, which will address topic areas that present the most critical barriers to achieving national energy and climate goals while proving the most resistant to solution by usual R&D enterprise structures. The Hubs are designed to accelerate the pace of scientific discovery and technology development to revolutionize how the U.S. produces, distributes, and uses energy. By the same token, they are intended to strengthen the Nation's competitiveness by building the expertise needed to lead our transition to a clean energy economy.

The Department's first three Energy Innovation Hubs, initiated in FY 2010, will explore Fuels from Sunlight, Energy Efficient Building Systems Design, and Modeling and Simulation for Nuclear Reactors. The Department already funds some promising R&D in these areas, and the Hubs will be able to build upon the new knowledge from these and other advances to reach the critical mass of R&D and engineering integration needed to accelerate major breakthroughs in these energy technologies. Each Hub will exist for a finite length of time and will focus on a single topic, but with work spanning the gamut from basic research, through engineering development, to facilitating commercialization by industry. Each Hub will be comprised of a highly collaborative team utilizing multiple scientific disciplines, engineering fields, and technology areas, working largely under one roof. By bringing together top talent across the full spectrum of R&D performers—including universities, private industry, non-profits, and government laboratories—each Hub is expected to conduct world-leading R&D in its topical area.

The Hubs are a central component of the Secretary of Energy's strategy to achieve the President's goals to reduce our dependence on foreign oil and our greenhouse gas emissions. The Hubs also embody the Secretary's goal to improve coordination between basic research and technology development. BES will support two Hubs in FY 2011, one focused on Fuels from Sunlight and a new Hub for Batteries and

Energy Storage. The primary objective in selecting the Hubs is to award the proposals that have the best chance to deliver transformative energy breakthroughs. The Hubs will therefore be selected on the basis of a competitive merit review; there are no preconceived goals for specific locations or geographical distribution of the Hubs. Universities, national laboratories, and the private sector—or partnerships among those groups—will be eligible to apply, similar to the DOE Bioenergy Research Center solicitation. Proposals will be selected based on external merit review and awards will provide support for research activities, not construction of new buildings. Additional information on the Hubs can be found at http://www.energy.gov/hubs/index.htm.

Scientific Workforce

The Office of Science, through its six research programs, supports the training of undergraduates, graduate students, and postdoctoral researchers as an integral part of the ongoing sponsored research activities at universities and DOE national laboratories. Office of Science programs also support the development of individual research programs of outstanding scientists early in their careers to stimulate research careers in disciplines supported by the Office of Science.

In addition, the Office of Science research programs support modest activities targeted towards undergraduate and graduate students, postdoctoral researchers, and K–12 science and math educators to educate and encourage new talent into fields important to the program-specific missions. These activities, in addition to the activities supported within the Workforce Development for Teachers and Scientists program, provide opportunities that will draw U.S. talent into science, technology, engineering, and mathematics; create the skilled scientific and technical workforce needed to develop solutions to our energy and environmental challenges in the 21st century; and enable the U.S. to continue to be the leader in science and innovation.

Undergraduate activities include intensive research training internships in specific areas such as geophysics, radiochemistry, nuclear science, computer science and computational-based sciences, plasma and fusion energy sciences, and climate science, and short courses in emerging areas in the physical sciences and engineering, including opportunities for groups underrepresented in the physical sciences. Graduate student level activities include support for short courses and lecture series as part of scientific professional society meetings; summer courses, lecture series, and experimental training courses in areas such as neutron and x-ray scattering, high energy physics, and genomic sciences; summer graduate research internships in targeted areas such as genomic science, radiochemistry, accelerator physics, and nuclear physics; and graduate research fellowships to support graduate study and research in areas of basic science and engineering important to the DOE mission. Opportunities directed towards K–12 educators include workshops, classroom presentations, and summer training programs that provide educators with content knowledge, materials, and activities related to the physical sciences and mathematics to use in the classroom.

Mission Readiness of Office of Science Laboratories

The mission readiness of a laboratory's facilities and infrastructure is the capability of those assets to enable delivery of the scientific mission assigned to that laboratory. Ensuring continued mission readiness into the future is the focus of the Science Laboratories Infrastructure program.

In FY 2009, the Office of Science began an Infrastructure Modernization initiative to revitalize Office of Science laboratories over ten years, with the goal of providing the modern laboratory infrastructure needed to deliver advances in science the Nation requires to remain competitive in the 21st century. Through this initiative, we are ensuring the laboratories have state-of-the-art facilities and utilities that are flexible, reliable, and sustainable, with environmentally stable research space and high performance computing space needed to support scientific discovery. New and renovated buildings and utilities will include the latest temperature and humidity controls, clean power, and isolation from vibration and electromagnetic interference where needed. Facility designs will consider human factors to ensure collaborative and interactive work environments and allow for the integration of basic to applied research and development. The initiative includes a portfolio of projects funded through the SLI budget that will provide modern laboratory space, renovate space that does not meet research needs, replace facilities that are no longer cost effective to renovate or operate, modernize utility systems to prevent failures and ensure efficiency, and/or remove excess facilities to allow safe and efficient operations. The investments will not only improve the Office of Science's mission readiness but will also reduce deferred maintenance backlog thereby improving the overall Asset Condition Index.

Means and Strategies

All research projects and facilities undergo regular peer review and merit evaluation based on procedures set down in 10 CFR 605 for the extramural grant program and under a similar process for the laboratory programs and scientific user facilities. All new projects are selected through peer review and merit evaluation.

Office of Science programs ensure effective management processes for cost-effective investments and timely delivery of projects and utilize input from the scientific community to ensure progress is made and opportunities are identified. Programs also form mutually beneficial partnerships with programs sharing common goals. The basic science supported by each program is coordinated with the activities of other programs within the Office of Science, with programs of the DOE applied technology offices and the National Nuclear Security Administration, and with programs of other Federal agencies. The Office of Science also promotes the transfer of basic research results to contribute to DOE missions in areas of energy, environment, and national security. Program-specific means and strategies are described in detail in the individual program budget narrative sections.

Validation and Verification

Progress against established plans is evaluated by periodic internal and external performance reviews. These reviews provide an opportunity to verify and validate performance. Monthly, quarterly, semiannual, and annual reviews consistent with specific program management plans are performed to ensure technical progress, cost and schedule adherence, and responsiveness to program requirements.

Office of Science
Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Ames Laboratory			
Advanced Scientific Computing Research	1,597	900	450
Basic Energy Sciences	21,485	19,563	19,563
Biological and Environmental Research	675	675	675
Workforce Development for Teachers and Scientists	463	240	556
Safeguards and Security	1,067	980	1,007
Total, Ames Laboratory	25,287	22,358	22,251
Ames Site Office			
Science Program Direction	536	585	621
Argonne National Laboratory			
Advanced Scientific Computing Research	53,721	54,570	68,205
Basic Energy Sciences	198,855	198,665	209,147
Biological and Environmental Research	28,627	29,266	28,913
Fusion Energy Sciences	125	125	125
High Energy Physics	17,113	13,422	13,568
Nuclear Physics	27,650	28,164	28,775
Workforce Development for Teachers and Scientists	1,916	466	2,012
Science Laboratories Infrastructure	10,000	8,000	15,000
Safeguards and Security	9,787	8,742	8,985
Total, Argonne National Laboratory	347,794	341,420	374,730
Argonne Site Office			
Science Program Direction	3,166	3,418	4,308
Berkeley Site Office			
Science Program Direction	3,685	4,462	4,586

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Brookhaven National Laboratory			
Advanced Scientific Computing Research	970	780	360
Basic Energy Sciences	201,326	235,186	247,915
Biological and Environmental Research	23,182	19,954	14,094
High Energy Physics	55,108	47,818	44,284
Nuclear Physics	176,957	179,418	192,981
Workforce Development for Teachers and Scientists	890	589	1,069
Science Laboratories Infrastructure	14,882	44,387	15,000
Safeguards and Security	11,824	11,632	11,955
Total, Brookhaven National Laboratory	485,139	539,764	527,658
Brookhaven Site Office			
Science Program Direction	3,930	5,120	5,445
Chicago Office			
Advanced Scientific Computing Research	54,656	53,611	27,917
Basic Energy Sciences	264,195	265,299	309,219
Biological and Environmental Research	167,669	160,043	161,632
Fusion Energy Sciences	149,054	152,083	151,342
High Energy Physics	142,626	134,504	133,068
Nuclear Physics	76,653	81,595	69,297
Workforce Development for Teachers and Scientists	135	164	5,000
Science Laboratories Infrastructure	756	0	0
Safeguards and Security	1,222	1,222	0
Science Program Direction	29,971	29,092	33,560
Congressionally Directed Projects	69,537	74,737	0
SBIR/STTR	154,439	0	0
Total, Chicago Office	1,110,913	952,350	891,035

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Fermi National Accelerator Laboratory			
Advanced Scientific Computing Research	910	790	180
High Energy Physics	389,043	397,273	408,705
Nuclear Physics	661	72	0
Workforce Development for Teachers and Scientists	294	105	637
Science Laboratories Infrastructure	0	0	7,524
Safeguards and Security	2,024	2,169	3,486
Total, Fermi National Accelerator Laboratory	392,932	400,409	420,532
Fermi Site Office			
Science Program Direction	2,112	2,363	2,700
Golden Field Office			
Workforce Development for Teachers and Scientists	869	176	722
Idaho National Laboratory			
Basic Energy Sciences	2,125	260	260
Biological and Environmental Research	2,238	1,717	1,304
Fusion Energy Sciences	2,272	2,172	2,222
Workforce Development for Teachers and Scientists	79	135	135
Congressionally Directed Projects	2,429	0	0
Total, Idaho National Laboratory	9,143	4,284	3,921
Lawrence Berkeley National Laboratory			
Advanced Scientific Computing Research	100,869	94,886	92,895
Basic Energy Sciences	163,071	139,607	143,183
Biological and Environmental Research	112,627	123,120	126,252
Fusion Energy Sciences	4,941	4,841	4,806
High Energy Physics	70,123	54,031	47,117
Nuclear Physics	28,151	27,136	21,271
Workforce Development for Teachers and Scientists	746	475	947
Science Laboratories Infrastructure	29,956	34,027	20,103
Safeguards and Security	5,529	5,059	5,201
Total, Lawrence Berkeley National Laboratory	516,013	483,182	461,775

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Lawrence Livermore National Laboratory			
Advanced Scientific Computing Research	14,652	13,929	7,632
Basic Energy Sciences	5,290	3,717	3,717
Biological and Environmental Research	25,362	14,891	11,503
Fusion Energy Sciences	13,886	10,744	13,145
High Energy Physics	1,552	794	793
Nuclear Physics	1,746	1,027	1,308
Workforce Development for Teachers and Scientists	130	89	294
Total, Lawrence Livermore National Laboratory	62,618	45,191	38,392
Los Alamos National Laboratory			
Advanced Scientific Computing Research	5,621	4,932	3,981
Basic Energy Sciences	41,050	33,287	35,208
Biological and Environmental Research	25,059	10,819	9,894
Fusion Energy Sciences	4,594	5,076	5,464
High Energy Physics	388	298	255
Nuclear Physics	12,064	10,014	15,128
Workforce Development for Teachers and Scientists	270	144	270
Congressionally Directed Projects	11,098	0	0
Total, Los Alamos National Laboratory	100,144	64,570	70,200
National Energy Technology Laboratory			
Workforce Development for Teachers and Scientists	782	586	1,150
National Renewable Energy Laboratory			
Advanced Scientific Computing Research	581	522	379
Basic Energy Sciences	12,608	7,209	7,209
Biological and Environmental Research	1,497	1,136	1,026
Workforce Development for Teachers and Scientists	50	55	100
Total, National Renewable Energy Laboratory	14,736	8,922	8,714
Nevada Site Office			
Basic Energy Sciences	232	244	244

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
New Brunswick Laboratory			
Science Program Direction	6,132	6,132	7,015
Oak Ridge Institute for Science and Education			
Advanced Scientific Computing Research	1,024	1,000	1,000
Basic Energy Sciences	5,237	642	642
Biological and Environmental Research	5,742	5,305	3,371
Fusion Energy Sciences	2,208	1,742	1,450
High Energy Physics	945	250	250
Nuclear Physics	3,097	789	729
Workforce Development for Teachers and Scientists	3,643	2,418	17,724
Safeguards and Security	1,710	1,626	1,671
Total, Oak Ridge Institute for Science and Education	23,606	13,772	26,837
Oak Ridge National Laboratory			
Advanced Scientific Computing Research	104,435	91,125	103,753
Basic Energy Sciences	325,637	328,071	330,246
Biological and Environmental Research	70,882	65,825	59,752
Fusion Energy Sciences	142,099	151,579	97,400
High Energy Physics	123	2	0
Nuclear Physics	26,943	25,831	44,141
Workforce Development for Teachers and Scientists	100	0	0
Science Laboratories Infrastructure	25,103	0	0
Safeguards and Security	9,094	8,895	9,144
Total, Oak Ridge National Laboratory	704,416	671,328	644,436
Oak Ridge National Laboratory Site Office			
Science Program Direction	4,565	4,357	4,457

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Oak Ridge Office			
Science Laboratories Infrastructure	5,079	5,214	5,260
Safeguards and Security	19,174	19,357	19,895
Science Program Direction	43,483	37,834	42,257
Total, Oak Ridge Office	67,736	62,405	67,412
Office of Scientific and Technical Information			
Advanced Scientific Computing Research	106	177	106
Basic Energy Sciences	106	344	229
Biological and Environmental Research	373	469	389
Fusion Energy Sciences	106	178	122
High Energy Physics	106	230	110
Nuclear Physics	106	196	0
Workforce Development for Teachers and Scientists	180	250	300
Science Laboratories Infrastructure	2,500	0	0
Safeguards and Security	583	490	504
Science Program Direction	9,153	8,916	8,963
Total, Office of Scientific and Technical Information	13,319	11,250	10,723
Pacific Northwest National Laboratory			
Advanced Scientific Computing Research	7,349	5,067	3,745
Basic Energy Sciences	25,366	19,574	19,574
Biological and Environmental Research	102,200	109,274	107,474
Fusion Energy Sciences	900	1,326	1,838
Workforce Development for Teachers and Scientists	1,187	613	1,211
Science Laboratories Infrastructure	52,775	0	0
Safeguards and Security	11,256	11,163	11,476
Total, Pacific Northwest National Laboratory	201,033	147,017	145,318
Pacific Northwest Site Office			
Science Program Direction	5,564	5,264	6,173

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Princeton Plasma Physics Laboratory			
Advanced Scientific Computing Research	740	758	322
Fusion Energy Sciences	71,250	72,676	76,017
High Energy Physics	230	272	237
Workforce Development for Teachers and Scientists	375	243	541
Safeguards and Security	2,242	2,178	2,237
Total, Princeton Plasma Physics Laboratory	74,837	76,127	79,354
Princeton Site Office			
Science Program Direction	1,734	1,805	2,058
Sandia National Laboratories			
Advanced Scientific Computing Research	9,831	8,169	8,436
Basic Energy Sciences	44,373	36,108	36,397
Biological and Environmental Research	6,459	1,600	520
Fusion Energy Sciences	2,730	2,290	2,490
Nuclear Physics	275	0	0
Workforce Development for Teachers and Scientists	550	21	926
Congressionally Directed Projects	4,624	0	0
Total, Sandia National Laboratories	68,842	48,188	48,769
Savannah River National Laboratory			
Basic Energy Sciences	480	435	435
Biological and Environmental Research	622	363	0
Fusion Energy Sciences	50	0	0
Workforce Development for Teachers and Scientists	0	75	75
Total, Savannah River National Laboratory	1,152	873	510

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
SLAC National Accelerator Laboratory			
Advanced Scientific Computing Research	200	200	200
Basic Energy Sciences	221,597	184,134	172,560
Biological and Environmental Research	5,352	4,150	4,150
High Energy Physics	91,024	88,824	87,177
Workforce Development for Teachers and Scientists	222	160	190
Science Laboratories Infrastructure	0	6,900	33,100
Safeguards and Security	2,679	2,643	2,716
Total, SLAC National Accelerator Laboratory	321,074	287,011	300,093
Stanford Site Office			
Science Program Direction	2,948	2,748	2,829
Thomas Jefferson National Accelerator Facility			
Advanced Scientific Computing Research	100	100	0
Basic Energy Sciences	900	900	0
Biological and Environmental Research	600	600	600
High Energy Physics	2,571	2,152	1,895
Nuclear Physics	119,618	112,321	129,893
Workforce Development for Teachers and Scientists	520	208	641
Science Laboratories Infrastructure	3,700	27,687	28,628
Safeguards and Security	1,504	1,432	1,470
Total, Thomas Jefferson National Accelerator Facility	129,513	145,400	163,127
Thomas Jefferson Site Office			
Science Program Direction	1,928	2,020	2,229

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Washington Headquarters			
Advanced Scientific Computing Research	1,410	62,484	106,439
Basic Energy Sciences	1,832	163,255	299,252
Biological and Environmental Research	6,010	54,975	95,351
Fusion Energy Sciences	303	21,168	23,579
High Energy Physics	1,716	70,613	91,541
Nuclear Physics	26,386	68,437	58,477
Workforce Development for Teachers and Scientists	182	13,466	1,100
Science Laboratories Infrastructure	629	1,385	1,385
Safeguards and Security	908	5,412	6,753
Science Program Direction	67,788	75,261	87,236
Congressionally Directed Projects	3,376	2,153	0
Total, Washington Headquarters	110,540	538,609	771,113
Waste Isolation Pilot Plant			
High Energy Physics	3,200	0	0
Total, Science	4,822,170	4,903,710	5,121,437

Office of Science

Major Changes or Shifts by Site

Argonne National Laboratory

- **Advanced Scientific Computing Research**: The Leadership Computing Facility will be undergoing site preparations for the 10-petaflop upgrade, while continuing to provide open high-performance computing capability with low electrical power consumption to enable scientific advances.

Fermi National Accelerator Laboratory

- **Science Laboratories Infrastructure**: The Utilities Upgrade project is initiated to upgrade the laboratory's industrial cooling water and high voltage electrical systems. Both of these systems are critical for the current and future mission at the laboratory. System components are at the end of their design life and replacement parts are no longer available.

Lawrence Berkeley National Laboratory

- **Advanced Scientific Computing Research**: The high performance computing resources at the National Energy Research Scientific Computing (NERSC) center will provide one petaflop of capacity computing to the Office of Science programs. The Energy Sciences network (ESnet) will begin deploying the 100 gigabit per second optical technologies developed through the Recovery Act funded Advanced Networking Initiative.

Oak Ridge National Laboratory

- **Advanced Scientific Computing Research**: The Leadership Computing Facility will explore hybrid architectures while providing more than two petaflops of open high-performance computing capability to enable scientific advances.

SLAC National Accelerator Laboratory

- **Basic Energy Sciences**: The Linac Coherent Light Source will begin its first full year of operations as a DOE user facility in FY 2011.
- **High Energy Physics**: In FY 2011, SLAC will begin full operations of the Facility for Accelerator Science and Experimental Test Beams (FACET) including a round of experiments in which the electron beam is accelerated by plasma wakefields (instead of the usual electromagnetic fields in a copper cavity). The ultimate goal of this effort will be demonstration of efficient accelerating structures with gradients well above 100 MeV per meter that could be incorporated into future accelerators.

Thomas Jefferson National Accelerator Facility

- **Science Laboratories Infrastructure**: The Utility Infrastructure Modernization project is initiated to upgrade the power distribution, cooling water, and communications systems to ensure the laboratory can continue to provide superconducting radio frequency expertise as well as research, development, and production of cryomodules in support of SC missions.

Site Description

Ames Laboratory

The Ames Laboratory is a program dedicated laboratory (Basic Energy Sciences). The laboratory is located on the campus of the Iowa State University, in Ames, Iowa, and consists of 12 buildings (327 thousand gross square feet of space). The average age of the buildings is 42 years. DOE does not own the land. Ames conducts fundamental research in the physical, chemical, and mathematical sciences associated with energy generation and storage. Ames is home to the **Materials Preparation Center**, which is dedicated to the preparation, purification, and characterization of rare-earth, alkaline-earth, and refractory metal and oxide materials.

- **Advanced Scientific Computing Research**: Ames conducts research in computer science and participates on Scientific Discovery through Advanced Computing (SciDAC) science application teams.
- **Basic Energy Sciences**: Ames supports experimental and theoretical research on rare earth elements in novel mechanical, magnetic, and superconducting materials. Ames scientists are experts on magnets, superconductors, and quasicrystals that incorporate rare earth elements. Ames also conducts research in focused areas within chemical and biochemical sciences.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Ames Site Office

The Ames Site Office provides the single federal presence with responsibility for contract performance at the Ames Laboratory. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Argonne National Laboratory

The Argonne National Laboratory (ANL) in Argonne, Illinois, is a multiprogram laboratory located on 1,500 acres in suburban Chicago. The laboratory consists of 99 buildings (4.6 million gross square feet of space). The average age of all the buildings is 37 years.

- **Advanced Scientific Computing Research**: ANL conducts research in applied mathematics and computer science, as well as research in advanced computing software tools. ANL also participates in scientific application partnerships and contributes to a number of the SciDAC science application teams. Further, it participates in both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. The ANL Leadership Computing Facility provides the computational science community with a world-leading computing capability dedicated to breakthrough science and engineering. The Leadership Computing Facility provides resources, including a 556-teraflop IBM Blue Gene/P system, which make computationally intensive projects of the largest scales possible.
- **Basic Energy Sciences**: ANL is home to research activities in broad areas of materials and chemical sciences. It is also the site of three user facilities—the Advanced Photon Source, the Center for Nanoscale Materials, and the Electron Microscopy Center for Materials Research.
  - The **Advanced Photon Source** is one of only three third-generation, hard x-ray synchrotron radiation light sources in the world. The 1,104-meter circumference facility—large enough to house a baseball park in its center—includes 34 bending magnets and 34 insertion devices, which generate a capacity of 68 beamlines for experimental research. Instruments on these beamlines attract researchers to study the structure and properties of materials in a variety of disciplines, including condensed matter physics, materials sciences, chemistry, geosciences, structural biology, medical imaging, and environmental sciences.
  - The **Electron Microscopy Center for Materials Research** develops and maintains capabilities for electron beam characterization and applies those capabilities to solve materials problems. The Center emphasizes three major areas: materials research, technique and instrumentation development, and operation as a national research facility. Research at the Center includes microscopy based studies on high-temperature superconducting materials, irradiation effects in metals and semiconductors, phase transformations, and processing related structure and chemistry of interfaces in thin films.
  - The **Center for Nanoscale Materials** provides capabilities for developing new methods for self assembly of nanostructures, exploring the nanoscale physics and chemistry of nontraditional electronic materials, and creating new probes for exploring nanoscale phenomena. The Center is organized around six scientific themes: nanomagnetism, bio-inorganic hybrids, nanocarbon, complex oxides, nanophotonics, and theory and simulation.
- **Biological and Environmental Research**: ANL conducts research on the molecular control of genes and gene pathways in microbes in addition to biological and geochemical research that supports environmental remediation. ANL operates beamlines for protein crystallography at the APS and also supports a growing community of users in environmental sciences.

In support of climate change research, ANL has oversight responsibility for coordinating the overall infrastructure operations of all three stationary Atmospheric Radiation Measure Climate Research Facility sites to ensure consistency, data quality, and site security and safety. This includes infrastructure coordination of communications, data transfer, and instrument calibration. ANL also provides the site manager for the Southern Great Plains site, who is responsible for coordinating the day-to-day operations and manages the deployment and operation of a mobile climate research facility. ANL conducts research on aerosol processes and properties, and develops and applies software to enable efficient long-term climate simulations on distributed-memory multiprocessor computing platforms. ANL is the task lead for developing new adjoint techniques in ocean modeling in the LBNL-led multi-lab effort on Abrupt Climate Change. In conjunction with Oak Ridge National Laboratory, Pacific Northwest National Laboratory, and six universities, ANL is a participating laboratory in the Carbon Sequestration in Terrestrial Ecosystems consortium, focusing on research to understand the processes controlling the rate of soil carbon accretion.

- **Fusion Energy Sciences**: ANL contributes a small effort in basic plasma science. In addition, ANL participates in the two-year planning study of the Fusion Simulation Program, contributing in the areas of algorithm development, code verification, software standards, and workflow needs and tools determination.
- **High Energy Physics**: ANL has unique capabilities in the areas of engineering, detector technology, and advanced accelerator and computing techniques. ANL continues to participate in the Tevatron and neutrino research programs at Fermi National Accelerator Laboratory (Fermilab) and analysis of data from these experimental programs will continue for several years. Other major ANL activities include working on the ATLAS (A Large Toroidal LHC Apparatus) experiment at the Large Hadron Collider, developing new detector technologies for future experiments, advancing accelerator R&D using the Argonne Wakefield Accelerator, and partnering with Fermilab in the development of superconducting radio frequency technology for future accelerators.
    - The **Argonne Wakefield Accelerator** is an R&D testbed that focuses on the physics and technology of high-gradient, dielectric-loaded structures for accelerating electrons. Two approaches are being pursued: a collinear, electron-beam driven dielectric-loaded wakefield accelerator and a two-beam accelerator. The goal is to identify and develop techniques which may lead to more efficient, compact, and inexpensive particle accelerators for future HEP applications. Research activities at this facility include the development of materials/coatings for high gradient research, dielectric-loaded and photonic band gap accelerating structures, left-handed meta-materials, high-power/high-brightness electron beams, and advanced beam diagnostics.
- **Nuclear Physics**: ANL operates the Argonne Tandem Linac Accelerator System national user facility, the world's premiere stable beam facility, and supports its corresponding R&D program. ANL nuclear scientists have expertise in detector development, computational techniques and advanced accelerator technology. Other activities include an on-site program of research using laser techniques (Atom Trap Trace Analysis); research programs at the Thomas Jefferson National Accelerator Facility (TJNAF), Fermilab, and Relativistic Heavy Ion Collider (RHIC); development and fabrication support for the Facility for Rare Isotope Beams (FRIB); theoretical calculations and investigations in subjects supporting the experimental research programs in medium energy and low energy physics; and data compilation and evaluation activities as part of the National Nuclear Data Program.

- The **Argonne Tandem Linac Accelerator System** national user facility provides variable energy and precision beams of stable ions from protons through uranium at energies near the Coulomb barrier (up to 10 MeV per nucleon) using a superconducting linear accelerator. Most work is performed with stable heavy-ion beams; however, an increasing percentage of the beams are rare isotope beams. The facility features a wide array of experimental instrumentation, including a world-leading ion-trap apparatus, the Advanced Penning Trap. The Gammasphere detector, coupled with the Fragment Mass Analyzer, is a unique world facility for measurement of nuclei at the limits of angular momentum (high-spin states). The facility nurtures a core competency in accelerator expertise with superconducting radiofrequency cavities for heavy ions that is relevant to the next generation of high-performance proton and heavy-ion linacs, and important to the SC mission and international stable and radioactive ion beam facilities. The combination of versatile beams and powerful instruments enables about 410 users annually to conduct research in a broad program in nuclear structure and dynamics, nuclear astrophysics, and fundamental interaction studies. The capabilities are being augmented by the fabrication of the Californium Rare Ion Beam Upgrade (CARIBU), which will be completed in FY 2010, as a source to provide new capabilities in neutron-rich radioactive beams. A new instrument, the Helical Orbital Spectrometer, employs a new concept to study reactions with radioactive beams from CARIBU.

- **Science Laboratories Infrastructure**: SLI enables DOE research missions at ANL by funding line item construction to maintain the general purpose infrastructure. The SLI program is currently funding the Energy Sciences Building project, which is constructing new, environmentally stable, specialized, and flexible space to replace some of the oldest and least effective research space for energy-related sciences.

- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Argonne Site Office

The Argonne Site Office provides the single federal presence with responsibility for contract performance at ANL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Berkeley Site Office

The Berkeley Site Office provides the single federal presence with responsibility for contract performance at the Lawrence Berkeley National Laboratory. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is a multiprogram laboratory located on 5,300 acres in Upton, New York. The laboratory consists of 331 SC buildings (4.0 million gross square feet of space). The average age of the buildings is 39 years. BNL creates and operates major facilities available to university, industrial, and government personnel for basic and applied research in the physical, biomedical, and environmental sciences, and in selected energy technologies.

- **Advanced Scientific Computing Research**: BNL conducts research in applied mathematics and participates on SciDAC science application teams. It also participates in SciDAC Centers for Enabling Technologies that focus on specific software challenges confronting users of petascale computers.
- **Basic Energy Sciences**: BNL conducts research efforts in materials sciences with emphasis on advanced scattering techniques, chemical sciences, and physical biosciences. It is also the site of two BES supported user facilities—the National Synchrotron Light Source and the Center for Functional Nanomaterials.
  - The **National Synchrotron Light Source** consists of two distinct electron storage rings. The x-ray storage ring is 170 meters in circumference and can accommodate 60 beamlines or experimental stations, and the vacuum-ultraviolet (VUV) storage ring can provide 25 additional beamlines around its circumference of 51 meters. Synchrotron light from the x-ray ring is used to determine the atomic structure of materials using diffraction, absorption, and imaging techniques. Experiments at the VUV ring help understand the atomic and electronic structure as well as the magnetic properties of a wide array of materials. Construction of a new synchrotron light source at BNL (the National Synchrotron Light Source II) is underway.
  - The **Center for Functional Nanomaterials** focuses on understanding the chemical and physical response of nanomaterials to make functional materials such as sensors, activators, and energy-conversion devices. It also provides clean rooms, general laboratories, and wet and dry laboratories for sample preparation, fabrication, and analysis. It includes equipment needed for laboratory and fabrication facilities for e-beam lithography, transmission electron microscopy, scanning probes and surface characterization, material synthesis and fabrication, and spectroscopy.
- **Biological and Environmental Research**: BNL operates beam lines for protein crystallography at the National Synchrotron Light Source for use by the national biological research community, research in biological structure determination, and research into new instrumentation for detecting x-rays and neutrons. BNL conducts molecular radiochemistry and imaging and instrumentation research, developing advanced technologies for biological imaging.
  - Climate change research includes the operation of the Atmospheric Radiation Measurement Climate Research Facility (ACRF) External Data resource that provides atmospheric system research investigators with data from non-ACRF sources, including satellite and ground-based systems. BNL scientists form an important part of the atmospheric system research science team, including providing special expertise in analyzing atmospheric data and simulating cloud and aerosol processes in climate models.
  - BNL is the lead for multi-institution research to address issues of model evaluation, development, and understanding of atmospheric processes.
  - BNL scientists play a leadership role in the operation of the Free-Air Carbon Dioxide Enrichment (FACE) experiment at the Duke Forest which seeks to understand how plants respond to elevated carbon dioxide concentrations in the atmosphere.
- **High Energy Physics**: BNL has unique resources in the engineering and technology for future accelerators and detectors, advanced computational resources, and the Accelerator Test Facility. BNL serves as the host laboratory for the U.S. ATLAS collaboration, which participates in the research of the ATLAS detector at the Large Hadron Collider. BNL manages the program of maintenance and operations for the ATLAS detector, operates the primary U.S. analysis facility for ATLAS data, and

is developing an analysis support center for U.S. based users. The group also contributes to the leadership and management of the U.S. International Linear Collider R&D effort and is a member of the Tevatron research collaboration at Fermilab.

BNL researchers have a leadership role in the Reactor Neutrino experiment in Daya Bay, China. BNL physicists are also involved in other neutrino physics efforts including research at the Neutrinos at the Main Injector (NuMI) facility with the Main Injector Neutrino Oscillation experiment at Fermilab and R&D and planning for future accelerator-based neutrino experiments, particularly the Long Baseline Neutrino Experiment.

- The BNL **Accelerator Test Facility** is a user facility that supports a broad range of advanced accelerator R&D. The core capabilities include a high-brightness photoinjector electron gun, a 70-MeV linac, high power lasers synchronized to the electron beam at a picosecond level, four beam lines, and a sophisticated computer control system. Participating researchers come from universities, national laboratories, and industries. Experiments carried out in this facility are proposal-driven and are typically in the areas involving interactions of high power electromagnetic radiation and high brightness electron beams, including laser acceleration of electrons and free-electron lasers. Other topics include the development of electron beams with extremely high brightness, photo-injectors, electron beam and radiation diagnostics, and computer controls.

- **Nuclear Physics**: Research activities include: use of relativistic heavy ion beams and polarized protons in the Relativistic Heavy Ion Collider (RHIC) to investigate hot, dense nuclear matter and to understand the internal "spin" structure of the proton; development of future detectors for RHIC; core competencies in accelerator R&D of beam-cooling techniques aimed at increasing the RHIC beam luminosity and of importance to other SC projects; R&D and calibration efforts directed towards research with neutrinos; a theory program emphasizing RHIC heavy ion and "spin" physics; data compilation and evaluation at the National Nuclear Data Center (NNDC) that is the central U.S. site for these national and international efforts; operations of the Brookhaven Linac Isotope Producer (BLIP) which produces research and commercial isotopes in short supply; and a research and development effort of new isotope production and processing techniques.

  - The **Relativistic Heavy Ion Collider** facility uses accelerators to inject beams into two rings of superconducting magnets of almost 4 kilometers circumference with 6 intersection regions where the beams can collide. RHIC can accelerate and collide a variety of heavy ions, including gold beams, up to an energy of 100 GeV per nucleon. RHIC is being used to search for and characterize hot, dense nuclear matter and has seen signs of the same quark-gluon plasma that is believed to have existed microseconds after the Big Bang. It can also collide polarized protons with beams of energy up to 250 GeV per nucleon—a unique capability. Two detectors are supported to provide complementary measurements, with some overlap in order to cross-calibrate the measurements: the Solenoidal Tracker at RHIC and the Pioneering High-Energy Nuclear Interacting Experiment.

  - The **Alternating Gradient Synchrotron** (AGS) accelerator provides high intensity pulsed proton beams up to 33 GeV on fixed targets and secondary beams of kaons, muons, pions, and anti-protons. The AGS is the injector of (polarized) proton and heavy-ion beams into RHIC, and its operations are supported by the NP Heavy Ion subprogram as part of the RHIC facility. The AGS is also utilized for radiation damage studies of electronic systems for NASA-supported work and work for other agencies.

  - The **Booster Synchrotron** accelerator, part of the RHIC injector, provides heavy-ion beams to a dedicated beam line (NASA Space Radiation Laboratory) for biological and electronic systems radiation studies funded by NASA.
  - The **Electron Beam Ion Source** (EBIS) accelerator and linac system will be completed in FY 2010 and will replace the aging Tandem Van de Graaff accelerators which have served as injectors for the Booster Synchrotron. EBIS, which was supported as a joint DOE/NASA project, promises greater efficiency, greater reliability, and lower maintenance costs as well as the potential for future upgrades.
  - The **National Nuclear Data Center** (NNDC) is the central U.S. site for national and international nuclear data and compilation efforts. The U.S. Nuclear Data program is the United States' repository for information generated in low- and intermediate-energy nuclear physics research worldwide. This information consists of both bibliographic and numeric data. The Center is a resource for a very broad user community in basic nuclear science research and in all aspects of nuclear technology, with relevance to homeland security and advanced fuel cycles for nuclear reactors. Nuclear Data program-funded scientists at U.S. national laboratories and universities contribute to the Center's activities and responsibilities.
  - The **Brookhaven Linac Isotope Producer** at BNL uses a linear accelerator that injects 200-MeV protons into the 33-GeV Alternating Gradient Synchrotron. The isotopes produced by BLIP, such as strontium-82, germanium-68, copper-67, and others, are used in medical diagnostic and therapeutic applications and other scientific research. The BLIP can operate in dedicated mode or in conjunction with RHIC operations.
- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure and remove excess facilities. The SLI program is currently funding the Renovate Science Laboratories, Phase II project that will modernize unsuitable laboratory space in buildings 510 (Physics) and 555 (Chemistry), allowing them to continue supporting research in Basic Energy Sciences and Nuclear and High Energy Physics. SLI is also funding construction of the Interdisciplinary Science Building, Phase I project at BNL that will provide high accuracy laboratories (e.g., equipped with precise temperature, humidity, and vibration controls), offices, and support space for energy-related research and development in a new interdisciplinary facility.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, protective force officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Brookhaven Site Office

The Brookhaven Site Office provides the single federal presence with responsibility for contract performance at BNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Chicago Office

The Chicago (CH) Office directly provides corporate support (procurement, legal, financial management, human resources, and facilities and infrastructure) to site offices responsible for program management oversight of six management and operating laboratories—the Ames, Argonne, Lawrence Berkeley, Brookhaven, Fermi, and Princeton laboratories—and one government-owned and government-operated Federal laboratory, the New Brunswick Laboratory. The administrative, business, and technical expertise of CH is shared SC-wide through the Integrated Support Center concept. CH also serves as SC's grant center, administering grants to about 300 colleges and universities in all 50 states, Washington, D.C., and Puerto Rico, as determined by the SC program offices as well as non-SC offices.

- **Advanced Scientific Computing Research**: ASCR funds research at over 70 academic institutions located in 34 states supporting over 130 principal investigators.
- **Basic Energy Sciences**: BES funds research at 170 academic institutions located in 50 states.
- **Biological and Environmental Research**: BER funds research at over 200 institutions, including colleges, universities, private industry, and other federal and private research institutions located in 45 states, Washington, DC, and Puerto Rico.
- **Fusion Energy Sciences**: FES funds research grants and cooperative agreements at more than 50 colleges and universities located in approximately 30 states.
- **High Energy Physics**: HEP supports about 300 research groups at more than 100 colleges and universities located in 36 states, Washington, D.C., and Puerto Rico.
- **Nuclear Physics**: NP funds approximately 200 research grants at 90 colleges and universities located in 35 states and Washington, DC.
- **Safeguards and Security**: Program management and funding for local security interests will be transferred from the Chicago Office to the Fermi National Accelerator Laboratory in FY 2011.

Fermi National Accelerator Laboratory

Fermi National Accelerator Laboratory is a program-dedicated laboratory (High Energy Physics) located on a 6,800-acre site in Batavia, Illinois. The laboratory consists of 355 buildings (2.3 million gross square feet of space). The average age of the buildings is 43 years. Fermilab is the largest U.S. laboratory for research in high-energy physics and, world-wide, is second in size only to CERN, the European Laboratory for Particle Physics. About 2,000 scientific users—scientists from universities and laboratories throughout the U.S. and around the world—use Fermilab for their research. Fermilab's mission is that of the high-energy physics program: to understand matter at its deepest level, to identify its fundamental building blocks, and to understand how the laws of nature determine their interactions.

- **Advanced Scientific Computing Research**: Fermilab participates in SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data. Fermilab also participates in SciDAC Centers for Enabling Technologies focusing on specific software challenges confronting users of petascale computers.
- **High Energy Physics**: Fermilab is the principal HEP experimental facility. Fermilab operates the **Tevatron** accelerator and colliding beam facility, which consists of a four-mile ring of superconducting magnets and two large multi-purpose detectors and is capable of accelerating protons and antiprotons to an energy of one trillion electron volts (1 TeV). The laboratory supports two Tevatron experiments, CDF and D-Zero, together home to about 1,400 physicists from Fermilab and other national laboratories, U.S. universities, and foreign universities and research institutes.
  - The Tevatron complex includes the **Neutrinos at the Main Injector** (NuMI) beamline, the world's highest intensity neutrino beam facility. NuMI provides a controlled beam of neutrinos to the Main Injector Neutrino Oscillation (MINOS) experiment located in the Soudan Mine in Minnesota and the Main Injector Neutrino v-A (MINERvA) experiment located onsite at Fermilab. The NuMI Off-Axis Neutrino Appearance (NOvA) experiment will upgrade the

beamline and exploit the increased beam power to make further discoveries in neutrino physics. NOvA is under construction and will be in full operation in 2014.

- Fermilab is host laboratory for the U.S. Compact Muon Solenoid (CMS) collaboration, which conducts research using the CMS detector at the LHC. Fermilab manages the program of maintenance and operations for the CMS detector and operates the primary U.S. data analysis center for CMS. Fermilab is also the host laboratory for the LHC Accelerator Research Program which manages U.S. accelerator physicists' efforts on the commissioning, operations, and upgrades of the LHC.
- Fermilab is a leading national laboratory for research and development of future particle accelerator technologies. For example, the large scale infrastructure needed for the fabrication, processing, and testing of superconducting radio frequency cavities and cryomodules is being built at Fermilab. This includes horizontal and vertical test stands for cavity testing, high quality clean rooms and well-equipped rigging areas for assembly of cryomodules. Fermilab is the lead U.S. laboratory coordinating the national R&D program in this area.
- Fermilab also has an active program in particle astrophysics and cosmology. Fermilab is leading the development and fabrication of a camera to be used in the Dark Energy Survey, has significant participation in research on the direct detection of dark matter and ultra high energy cosmic rays, and is doing R&D towards next generation dark energy and dark matter experiments.
- Fermilab also has a significant program for R&D on advanced detector components for a variety of physics applications. The laboratory also maintains and operates a fixed target beam for testing of detector elements that hosts university, national laboratory, and international R&D groups.

- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure at Fermilab. In FY 2011, the SLI program is requesting funding for the Utilities Upgrade project to upgrade outdated industrial cooling water and high voltage electrical systems.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Fermi Site Office

The Fermi Site Office provides the single federal presence with responsibility for contract performance at Fermilab. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Idaho National Laboratory

Idaho National Laboratory (INL) is a multiprogram laboratory located on 572,000 acres in Idaho Falls, Idaho. Within the laboratory complex are nine major applied engineering, interim storage, and research and development facilities.

- **Basic Energy Sciences**: INL supports studies on materials sciences for nuclear fuels and the relationship of microstructure to materials properties.

- **Biological and Environmental Research**: INL is conducting research in subsurface biogeochemical research related to clean up of the nuclear weapons complex with an emphasis on understanding coupled processes affecting contaminant transport.
- **Fusion Energy Sciences**: Research at INL focuses on the safety aspects of magnetic fusion concepts for existing and future machines, such as a burning plasma experiment, and further developing the domestic fusion safety database using existing collaborative arrangements to conduct work on international facilities. In addition, INL has expanded their research and facilities capabilities to include tritium science activities at the Safety and Tritium Applied Research (STAR) national user facility—a small tritium laboratory where the fusion program can conduct tritium material science, chemistry, and safety experiments. INL also coordinates safety codes and standards within the ITER program.
- **Nuclear Physics:** The Advanced Test Reactor is supported for the production of select isotopes for the Isotope Program, such as gadolinium-153, an important isotope for applications such as positron emission tomography imaging.

Lawrence Berkeley National Laboratory

The Lawrence Berkeley National Laboratory (LBNL) is a multiprogram laboratory located in Berkeley, California, on a 200-acre site adjacent to the Berkeley campus of the University of California. The laboratory consists of 106 buildings (1.7 million gross square feet of space). The average age of the buildings is 40 years. LBNL is dedicated to performing leading-edge research in the biological, physical, materials, chemical, energy, and computer sciences. The land is leased from the University of California.

- **Advanced Scientific Computing Research**: LBNL conducts research in applied mathematics and computer science, as well as research in advanced computing software tools. LBNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. LBNL manages the Energy Sciences network (ESnet). ESnet is one of the worlds most effective and progressive science-related computer networks that provides worldwide access and communications to Department of Energy facilities. LBNL is also the site of the National Energy Research Scientific Computing Center (NERSC), which provides a range of high-performance, state-of-the-art computing resources that are a critical element in the success of many SC research programs.
- **Basic Energy Sciences**: LBNL is home to major research efforts in materials sciences with emphasis on nanoscience, chemical sciences, geosciences, biosciences, and solar fuels research. It is also the site of three Basic Energy Sciences supported user facilities—the Advanced Light Source (ALS), the National Center for Electron Microscopy, and the Molecular Foundry.
    - The **Advanced Light Source** provides vacuum-ultraviolet light and x-rays for probing the electronic and magnetic structure of atoms, molecules, and solids, such as those for high-temperature superconductors. The high brightness and coherence of the ALS light are particularly suited for soft x-ray imaging of biological structures, environmental samples, polymers, magnetic nanostructures, and other inhomogeneous materials. Other uses of the ALS include holography, interferometry, and the study of molecules adsorbed on solid surfaces. The pulsed nature of the ALS light offers special opportunities for time resolved research, such as the dynamics of chemical reactions. Shorter wavelength x-rays are also used at structural biology experimental stations for x-ray crystallography and x-ray spectroscopy of proteins and other important biological macromolecules. The ALS User Support Building (USB) will provide high-

quality user support space in sufficient quantity to accommodate the very rapid growth in the number of ALS users and to accommodate projected future expansion of beamlines, instruments, and accelerator upgrades. The USB will contain staging areas for ALS experiments, space for a long beamline that will extend from the floor of the ALS into the USB, and temporary office space for visiting users.

- The **National Center for Electron Microscopy** provides instrumentation for high-resolution, electron-optical microcharacterization of atomic structure and composition of metals, ceramics, semiconductors, superconductors, and magnetic materials. This facility contains the highest resolution electron microscope in the U.S., the Transmission Electron Aberration Corrected Microscope.
- The **Molecular Foundry** provides users with instruments, techniques, and collaborators to enhance the study of the synthesis, characterization, and theory of nanoscale materials. Its focus is on the multidisciplinary development and understanding of both "soft" (biological and polymer) and "hard" (inorganic and microfabricated) nanostructured building blocks and the integration of these building blocks into complex functional assemblies. Scientific themes include inorganic nanostructures; nanofabrication; organic, polymer, and biopolymer nanostructures; biological nanostructures; imaging and manipulation of nanostructures; and theory of nanostructures. The facility offers expertise in a variety of techniques for the study of nanostructures, including electronic structure and excited-state methods, *ab initio* and classical molecular dynamics, quantum transport, and classical and quantum Monte Carlo approaches.

- **Biological and Environmental Research**: LBNL is the lead national laboratory managing the **Joint Genome Institute** (JGI); the principal goal of which is high-throughput genome sequencing and analysis techniques. The laboratory also conducts research on the molecular mechanisms of cell responses to low doses of radiation and on microbial systems biology research as part of Genomic Science. LBNL operates beamlines for determination of protein structure at the ALS for use by the national and international biological research community. The ALS also supports and is used by a growing environmental science community.
  - LBNL supports subsurface biogeochemical research and provides a systems approach to predictively understand subsurface biogeochemical processes impacting metal and radionuclide contaminant transport and remediation in subsurface environments.
  - LBNL conducts research to advance fundamental understanding of DOE-relevant microorganisms and microbial communities using systems biology approaches and analyses at the whole organism level and across multiple spatial and temporal scales.
  - LBNL conducts research on carbon cycling and carbon sequestration on terrestrial ecosystems to understand the processes controlling the exchange of CO_2 between terrestrial ecosystems and the atmosphere. It also conducts research on biological and ecological responses to climatic and atmospheric changes.
  - It also develops scalable implementation technologies that allow widely used climate models to run effectively and efficiently on massively parallel processing supercomputers. LBNL studies and quantifies the risks of abrupt climate change during the 21st century. LBNL is leading a multi-lab activity on Abrupt Climate Change Modeling through a series of linked projects that examine: dynamics of ice shelf-ocean interaction and evaluation of marine ice sheet stability, boreal/Arctic climate positive feedbacks, rapid destabilization of methane hydrates in Arctic

Ocean sediments, and mega-droughts in North America. It leads the task for examining boreal/Arctic feedbacks in this project.

- The **Joint BioEnergy Institute** (JBEI) at LBNL, one of three Genomic Science Bioenergy Research Centers, is focused on model plant systems (*Arabidopsis* and rice) for which the laboratory capabilities are well developed. Early results on their more tractable genomics will be shifted to potential bioenergy feedstock plants. The JBEI is experimenting with *E. coli* and yeast, two workhorse microbes for conversion, as well as the use of ionic liquids for deconstruction of biomass material. JBEI is also investigating biological production of alternatives to ethanol that would be better substitutes for gasoline and diesel.

- **Fusion Energy Sciences**: LBNL has been conducting research in developing ion beams for applications to high energy density laboratory plasmas (HEDLP) and inertial fusion energy sciences. Currently the laboratory has two major experimental systems for doing this research: the Neutralized Drift Compression Experiment (NDCX) and the High Current Experiment. Both experiments are directed at answering the question of how ion beams can be produced with the intensity required for research in HEDLP and inertial fusion energy sciences. LBNL is currently upgrading the Neutralized Drift Compression Experiment from its present configuration to NDCX-II. The NDCX-II facility will advance the science of drift compression of an ion beam to intensify the beam, and enhance the energy on target of the ion beam by a factor of 100. LBNL conducts this research together with the Lawrence Livermore National Laboratory and Princeton Plasma Physics Laboratory through the Heavy Ion Fusion Science Virtual National Laboratory.

- **High Energy Physics**: LBNL has unique capabilities in the areas of superconducting magnet R&D, engineering and detector technology, the design of advanced electronic devices, computational resources, and the design of modern, complex software codes for HEP experiments. LBNL participates in the research of the ATLAS detector at the Large Hadron Collider, and has a leading role in providing the software and computing infrastructure for ATLAS. LBNL physicists are also involved in neutrino physics research using reactor-produced neutrinos, and provide management expertise to the Reactor Neutrino experiment at Daya Bay, China.

  The Laser Optics and Accelerator Systems Integrated Studies group has begun work on the Berkeley Lab Laser Accelerator (BELLA) project whose goal is the development of the 10-GeV laser-wakefield accelerator module using a petawatt laser.

  LBNL also has an active program in particle astrophysics and cosmology, providing leadership in the development of innovative detector technologies and in the application of high energy physics analysis methods to astronomical observations. LBNL physicists lead ongoing studies of dark energy using supernovae and baryon acoustic oscillations, and continues R&D for a space-based dark energy mission. LBNL operates the Microsystems Laboratory where new detector technologies have been developed for collider physics research and new devices to study dark energy and the cosmic microwave background. LBNL is also host to the Particle Data Group, which annually coordinates compilation and synthesis of high-energy physics experimental data into compendia which summarize the status of all major subfields of HEP.

- **Nuclear Physics**: LBNL supports a variety of activities focused primarily on the low energy and heavy ion NP subprograms. These include fabrication of a next-generation gamma-ray detector system, Gamma Ray Energy Tracking In-Beam Nuclear Array (GRETINA); research with the STAR detector located at BNL's RHIC facility; and development of future detector systems for RHIC. Also included are operation of the Parallel Distributed Systems Facility aimed at heavy ion and low energy physics computation; fabrication of a detector upgrade for the A Large Ion Collider

Experiment (ALICE) detector heavy ion program at LHC; research at the KamLAND detector in Japan that is performing neutrino studies. In addition, development and fabrication of next generation neutrino detectors, including leading the effort on U.S. participation in the Cryogenic Underground Observatory for Rare events (CUORE) experiment in Italy; and a theory program with an emphasis on relativistic heavy ion physics are conducted. Data compilation and evaluation activities supporting the National Nuclear Data Center at BNL; and R&D of electron-cyclotron resonance ion sources for the Facility for Rare Isotope Beams are also conducted at LBNL. The 88-Inch Cyclotron at LBNL is a facility for testing electronic circuit components for radiation "hardness" to cosmic rays, supported by the National Reconnaissance Office and the U.S. Air Force, and for a small in-house research program supported by NP.

- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure and the cleanup and removal of excess facilities at LBNL. The SLI program is currently funding the Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II project at LBNL that will replace seismically-poor buildings and trailers with a new general purpose laboratory/office building supporting Life Sciences, seismically upgrading the site-wide Hazardous Waste Handling Facility, and upgrading and modernizing an existing Life Sciences building (Building 74).
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Lawrence Livermore National Laboratory

Lawrence Livermore National Laboratory (LLNL) is a multiprogram laboratory located on 821 acres in Livermore, California. This laboratory was built in Livermore as a weapons laboratory 42 miles from the campus of the University of California at Berkeley to take advantage of the expertise of the university in the physical sciences.

- **Advanced Scientific Computing Research**: LLNL conducts research in applied mathematics and computer science. LLNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers.
- **Basic Energy Sciences**: LLNL conducts research in focused areas related to extreme environments and the limits of length and time scales within materials sciences and geosciences.
- **Biological and Environmental Research**: LLNL is one of the major national laboratory partners supporting the Joint Genome Institute (JGI), the principal goal of which is high-throughput genome sequencing and analysis.
    - LLNL conducts research including development of novel technologies to study structure and function of environmental microbial communities.
    - Through the program for Climate Model Diagnosis and Intercomparison, LLNL provides the international leadership to develop and apply diagnostic tools to evaluate and improve the performance of climate models. Virtually every climate modeling center in the world participates in this unique program. It also conducts research to improve understanding of the climate system, particularly the climate effect of clouds and aerosol properties and processes and climate change feedbacks on carbon cycling.

  - LLNL is improving model representation of the main processes, clouds, aerosols and the cryosphere, that drive the rapid decrease in Arctic ice cover as well as examining the implications of those decreases on future climate. It also is the task lead for studying the clathrate hypothesis in the LBNL-led multi-laboratory effort on Abrupt Climate Change.
  - LLNL also supports the ARM Climate Research Facility through the development and support of data sets designed for modelers.
  - LLNL supports subsurface biogeochemistry research on the fate and transport of plutonium and other actinide contaminants in the environment.
  - LLNL is a partner in the LBNL-led Joint BioEnergy Institute.
- **Fusion Energy Sciences**: LLNL works with LBNL and PPPL through the Heavy-Ion Fusion Virtual National Laboratory in advancing the physics of heavy ion beams as a driver for high energy density laboratory plasmas and inertial fusion energy sciences. It also conducts research on fast ignition concepts for applications in research on high energy density physics and inertial fusion energy sciences. The LLNL program also includes collaborations with General Atomics on the DIII-D tokamak and benchmarking of fusion physics computer models with experiments such as DIII-D. LLNL carries out research in the simulation of turbulence and its effect on transport of heat and particles in magnetically confined plasmas. In addition, LLNL carries out research in support of plasma chamber and plasma-material interactions.
- **High Energy Physics**: HEP supports experimental physics research and technology R&D at LLNL, using unique capabilities of the laboratory primarily in the areas of engineering and detector technology and advanced accelerator R&D.
- **Nuclear Physics**: The LLNL program supports research in relativistic heavy ion physics as part of the PHENIX collaboration at RHIC and the ALICE experiment at LHC, in nuclear data and compilation activities, in R&D for neutrino-less double beta decay experiments, nuclear structure with radioactive ion beams, research on super heavy nuclei, and in theoretical studies in the areas of nuclear structure studies, low energy nuclear reactions, and lattice QCD.

Los Alamos National Laboratory

Los Alamos National Laboratory (LANL) is a multiprogram laboratory located on 30,413 acres in Los Alamos, New Mexico.

- **Advanced Scientific Computing Research**: LANL conducts research in applied mathematics and computer science and in advanced computing software tools. LANL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes, which focus on specific software challenges confronting users of petascale computers.
- **Basic Energy Sciences**: LANL is home to research efforts in materials sciences to control functionality, chemical sciences, and geosciences.

  LANL is also the site of two BES supported user facilities: the Manuel Lujan Jr. Neutron Scattering Center (Lujan Center) and the Center for Integrated Nanotechnologies (CINT).

  - The **Manuel Lujan Jr. Neutron Scattering Center** provides an intense pulsed source of neutrons to a variety of spectrometers for neutron scattering studies. The Lujan Center features instruments for measurement of high-pressure and high-temperature samples, strain measurement, liquid studies, and texture measurement. The facility has extensive experience in handling actinide samples. The Lujan Center is part of the Los Alamos Neutron Science Center (LANSCE), which is comprised of a high-power 800-MeV proton linear accelerator, a proton storage ring, production targets to the Lujan Center and the Weapons Neutron Research facility, and a variety of associated experiment areas and spectrometers for national security research and civilian research.

- The **Center for Integrated Nanotechnologies** is devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials. Through its core facility in Albuquerque, New Mexico, and its gateways to both Sandia National Laboratories and Los Alamos National Laboratory, CINT provides access to tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT supports five scientific thrusts that serve as synergistic building blocks for integration research: nano-bio-micro interfaces, nanophotonics and nanoelectronics, complex functional nanomaterials, nanomechanics, and theory and simulation.

- **Biological and Environmental Research**: LANL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput genome sequencing and analysis. One of LANL's roles in the JGI involves the production of high quality "finished" DNA sequence.
  - LANL conducts research on the genomic analysis of complex microbial communities from environmental soil samples.
  - Activities in structural biology include the operation of an experimental station for protein crystallography at LANSCE for use by the national biological research community.
  - In support of BER's climate change research, LANL manages the day-to-day operations at the Tropical Western Pacific Atmospheric Radiation Measurement Climate Research Facility (ACRF) site. In addition, LANL manages the deployment and operation of the ACRF mobile facility.
  - LANL also has a crucial role in the development, optimization, and validation of coupled sea ice and oceanic general circulation models and coupling them to atmospheric general circulation models for implementation on massively parallel computers.
  - LANL is improving representation of the main processes, clouds, aerosols and the cryosphere, that drive the rapid decrease in Arctic ice cover as well as examining the implications of those decreases on future climate.
  - LANL leads a SciDAC effort for simulating subsurface biogeochemical processes impacting uranium transport in groundwater using high performance computers and is the task lead for developing ice-sheet models in the LBNL-led multi-laboratory effort on Abrupt Climate Change.
- **Fusion Energy Sciences**: LANL has developed a substantial experimental system for research in magnetized target fusion, an important innovative confinement concept, and a thrust area in magnetized high energy density laboratory plasmas. The laboratory leads research in a high-density, compact plasma configuration called field reversed configuration. LANL supports the creation of computer codes for modeling the stability of magnetically confined plasmas, including tokamaks and innovative confinement concepts. The work also provides theoretical and computational support for the Madison Symmetric Torus experiment, a proof-of-principle experiment in reversed field pinch at the University of Wisconsin in Madison. LANL develops advanced diagnostics for fusion experiments, such as the rotating magnetic field as a current drive mechanism for the Field Reversed Configuration Experiment at the University of Washington in Seattle. The laboratory is also doing

research in inertial electrostatic confinement, another innovative confinement concept. LANL also supports the tritium processing activities needed for ITER.

- **High Energy Physics**: HEP supports theoretical physics research at LANL, using unique capabilities of the laboratory in high-performance computing for advanced simulations.
- **Nuclear Physics**: NP supports a broad program of research at LANL. These activities include a research and development effort in relativistic heavy ions using the PHENIX detector at RHIC and development of next generation instrumentation for RHIC. Research on the quark substructure of the nucleon in experiments at Fermilab and the "spin" structure of nucleons at RHIC using polarized proton beams; measurement of oscillations of anti-neutrinos with the Mini Booster Neutrino Experiment (MiniBooNE) and R&D directed at future studies of the properties of neutrinos are also conducted. Participation in the fabrication of an experiment to search for the electric dipole moment of the neutron, to be located at the Fundamental Neutron Physics Beamline at the Spallation Neutron Source; a modest program of neutron beam research that utilizes beams from the LANSCE facility for fundamental physics measurements are also conducted at LANL. A broad program of theoretical research, nuclear data, and compilation activities as part of the U.S. Nuclear Data program; operations of the Isotope Production Facility, which produces research and commercial isotopes in short supply; and a research and development effort of new isotope production and processing techniques are conducted as well.
    - At LANL, the 100-MeV **Isotope Production Facility (IPF)** produces various radioactive isotopes, including germanium-68 (a calibration source for positron emission tomography PET scanners); strontium-82 (the parent of rubidium-82, used in cardiac PET imaging); and arsenic-73 (used as a biomedical tracer). The IPF is dependent on LANSCE and operates in parallel to LANSCE.

National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) is a program-dedicated laboratory located on 632 acres in Golden, Colorado. NREL's focus is on renewable energy technologies such as photovoltaics and other means of exploiting solar energy. It is the world leader in renewable energy technology development. Since its inception in 1977, NREL's mission is to develop renewable energy and energy efficiency technologies and transfer these technologies to the private sector.

- **Advanced Scientific Computing Research**: NREL participates in SciDAC science application teams including efforts focused on computational nanoscience and computational biology.
- **Basic Energy Sciences**: NREL conducts fundamental research in the chemical sciences, biosciences, and materials sciences, which are primarily devoted to the conversion of solar energy to electricity and fuels.
- **Biological and Environmental Research:** NREL conducts research on the biological production of hydrogen and is a partner in the Oak Ridge National Laboratory-led Genomic Science BioEnergy Science Center.

New Brunswick Laboratory

The New Brunswick Laboratory (NBL), located at the Argonne National Laboratory in Illinois, is a government-owned, government-operated center for analytical chemistry and measurement science of nuclear materials. In this role, NBL performs measurements of the elemental and isotopic compositions for a wide range of nuclear materials. The NBL is the U.S. Government's Nuclear Materials

Measurements and Reference Materials Laboratory and the National Certifying Authority for nuclear reference materials and measurement calibration standards. NBL provides reference materials, measurement and interlaboratory measurement evaluation services, and technical expertise for evaluating measurement methods and safeguards measures in use at other facilities for a variety of Federal program sponsors and customers. The NBL also functions as a Network Laboratory for the International Atomic Energy Agency. The NBL is administered through and is a part of the Chicago Office. NBL consists of one 58 year-old building (85 thousand gross square feet of space).

Oak Ridge Institute for Science and Education

The Oak Ridge Institute for Science and Education (ORISE), operated by Oak Ridge Associated Universities (ORAU), is located on a 179-acre site in Oak Ridge, Tennessee. ORISE has 12 buildings (116 thousand gross square feet of space). The average age of all the buildings is 53 years. Established in 1946, ORAU is a university consortium leveraging the scientific strength of major research institutions to advance science and education by partnering with national laboratories, government agencies, and private industry. ORISE focuses on scientific initiatives to research health risks from occupational hazards, assess environmental cleanup, respond to radiation medical emergencies, support national security and emergency preparedness, and educate the next generation of scientists.

- **Advanced Scientific Computing Research**: ORISE provides administrative support for panel reviews, site reviews, and Advanced Scientific Computing Advisory Committee meetings. It also assists with the administration of topical scientific workshops.
- **Basic Energy Sciences**: ORISE provides administrative support for panel reviews and site reviews. It also assists with the administration of topical scientific workshops and provides administrative support for other activities such as for the reviews of construction projects.
- **Biological and Environmental Research**: ORISE coordinates activities associated with the peer review of research proposals and applications.
- **Fusion Energy Sciences**: ORISE supports the operation of the Fusion Energy Sciences Advisory Committee and administrative aspects of some FES program peer reviews. It also acts as an independent and unbiased agent to administer the FES Graduate and Postgraduate Fellowship programs.
- **High Energy Physics**: ORISE provides support in the area of program planning and review.
- **Nuclear Physics**: ORISE supports the Holifield Radioactive Ion Beam Facility (HRIBF) and its research program through a close collaboration with university researchers using HRIBF. ORISE also provides support to the NP program in the area of merit peer review.
- **Workforce Development:** ORISE manages the DOE-National Science Foundation (NSF) program supporting graduate students to attend the Lindau Meeting of Nobel Laureates.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is a multiprogram laboratory located on a 21,000-acre reservation at Oak Ridge, Tennessee. The laboratory's 1,100-acre main site on Bethel Valley Road contains 237 buildings (3.7 million gross square feet of space). The average age of all the buildings is 40 years.

- **Advanced Scientific Computing Research**: ORNL conducts research in applied mathematics and computer science, as well as research in advanced computing software tools. ORNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers. The Leadership Computing Facility at ORNL is operating the world's most powerful high performance computer, a two-petaflop Cray Baker system which makes computationally intensive projects of the largest scales possible.
- **Basic Energy Sciences**: ORNL is home to major research efforts in materials and chemical sciences emphasizing fundamental understanding of materials behavior and interfacial phenomena with additional programs in geosciences. It is also the site of four BES supported user facilities—the Spallation Neutron Source (SNS), the High Flux Isotope Reactor (HFIR), Shared Research Equipment User Facility, and the Center for Nanophase Materials Sciences.
  - The **Spallation Neutron Source** is a next-generation short-pulse spallation neutron source for neutron scattering that is significantly more powerful (by about a factor of 10) than any other spallation neutron source in existence. The SNS consists of a linac-ring accelerator system that delivers short (microsecond) proton pulses to a target/moderator system where neutrons are produced by a process called spallation. The neutrons produced are then used for neutron scattering experiments. Specially designed scientific instruments use these pulsed neutron beams for a wide variety of investigations. There is initially one target station that can accommodate 24 instruments; the potential exists for adding more instruments and a second target station.
  - The **High Flux Isotope Reactor** is a light-water cooled and moderated reactor to provide state-of-the-art facilities for neutron scattering, materials irradiation, and neutron activation analysis and is the world's leading source of elements heavier than plutonium for research, medicine, and industrial applications. The neutron scattering experiments at HFIR reveal the structure and dynamics of a wide range of materials. The neutron-scattering instruments installed on the four horizontal beam tubes are used in fundamental studies of materials of interest to solid-state physicists, chemists, biologists, polymer scientists, metallurgists, and colloid scientists. A number of improvements at HFIR have increased its neutron scattering capabilities to 12 state-of-the-art neutron scattering instruments on the world's brightest beams of steady-state neutrons.
  - The **Shared Research Equipment User Facility** makes available state-of-the-art electron beam microcharacterization facilities for a wide diversity of user research focused on atomic scale correlation of structure, chemistry, and properties in a wide range of metallic, ceramic, and other structural materials including characterization of magnetic materials, catalysts, semiconductor device materials, high temperature superconductors, and surface-modified polymers.
  - The **Center for Nanophase Materials Sciences** integrates nanoscale science with neutron science; synthesis science; and theory, modeling, and simulation. Scientific themes include macromolecular complex systems, functional nanomaterials, nanoscale magnetism and transport, catalysis and nano building blocks, and nanofabrication.
- **Biological and Environmental Research**: ORNL has a leadership role in research focused on the ecological aspects of global environmental change. It supports basic research through ecosystem-scale manipulative experiments in the field, laboratory experiments involving model ecosystems exposed to global change factors, and development and testing of computer simulation models

designed to explain and predict effects of climatic change on the structure and functioning of terrestrial ecosystems.

- ORNL is the home of a Free-Air CO_2 Enrichment experiment which facilitates research on terrestrial carbon processes and the development of terrestrial carbon cycle models.
- ORNL, in conjunction with ANL, PNNL, and six universities, plays a principle role in the Carbon Sequestration in Terrestrial Ecosystems consortium which is focusing on research to enhance the capacity, rates, and longevity of carbon sequestration in terrestrial ecosystems.
- ORNL houses the Carbon Dioxide Information Analysis Center and Atmospheric Radiation Measure Climate Research Facility (ACRF) archive, providing data to carbon cycle and atmospheric system research scientists respectively.
- ORNL has an active research program to improve climate predictions and enhance scientific understanding of climate impacts and adaptation opportunities through strengthening the coupling between Earth System Models and Integrated Assessment Models. ORNL scientists provide improvement in formulations and numerical methods necessary to improve climate models.
- ORNL scientists make important contributions to the subsurface biogeochemical research activities, providing special leadership on mercury biogeochemical studies. ORNL also manages a field site for environmental research to advance an understanding and predictive capability of coupled hydrologic, geochemical, and microbiological processes that control the mobility of radionuclides across a range of scales in the environment.
- ORNL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput genome sequencing and analysis. One of ORNL's roles in the JGI involves the annotation (assigning biological functions to genes) of completed genomic sequences.
- ORNL conducts microbial systems biology research as part of Genomic Science.
- The **BioEnergy Science Center** at ORNL, one of three Genomic Science Bioenergy Research Centers, is focusing attention on two prime candidate feedstock plants, the poplar tree and switchgrass, as well as engineering microbes to enable more efficient biomass conversion by combining several steps.

- **Fusion Energy Sciences**: ORNL develops a broad range of components that are critical for improving the research capability of fusion experiments located at other institutions and that are essential for developing fusion as an environmentally acceptable energy source. The laboratory is a leader in fusion materials science, in the theory of heating of plasmas by electromagnetic waves, antenna design, and design and modeling of pellet injectors to fuel the plasma and control the density of plasma particles. The laboratory is also the site of the Controlled Fusion Atomic Data Center and its supporting research programs. ORNL is also a leader in stellarator theory. ORNL hosts the U.S. ITER Project Office and is the lead laboratory managing the U.S. Contributions to ITER major item of equipment project.
- **Nuclear Physics**: NP supports a diverse program of research at ORNL. These activities include: the research, development, and operations of the Holifield Radioactive Ion Beam Facility (HRIBF) that is operated as a national user facility; a relativistic heavy ion group that is involved in a research program using the PHENIX detector at RHIC and ALICE at LHC. The development of and research with the Fundamental Neutron Physics Beamline (FNPB) at the Spallation Neutron Source,

including the lead role of the prime experiment for FNPB, the neutron electric dipole moment experiment MIE; a theoretical nuclear physics effort that emphasizes investigations of nuclear structure and astrophysics; and nuclear data and compilation activities that support the national nuclear data effort are also conducted. In additiona, accelerator core competencies in rare isotope beam development and high power targets; research on the possible existence of super heavy nuclei; R&D efforts in development of next-generation neutrino-less double beta decay experiments; isotope processing capabilities; R&D efforts associated with radioisotope and stable isotope production and processing; and the operations of the National Isotope Data Center are provided for. Enriched stable isotopes are processed at ORNL materials and chemical laboratories and radioactive isotopes are chemically processed and packaged in hot cells in a radiochemical laboratory and the Radiochemical Engineering Development Center.

  - The **Holifield Radioactive Ion Beam Facility** is the only radioactive nuclear beam facility in the U.S. to use the Isotope Separator On-Line method and is used annually by about 260 scientists for studies in nuclear structure, dynamics, and astrophysics using radioactive beams. HRIBF accelerates secondary radioactive beams of fission fragments to higher energies (up to 10 MeV per nucleon) than any other facility in the world with a broad selection of ions. HRIBF conducts accelerator R&D on targets and ion sources and low energy ion transport for radioactive beams. The fabrication of a second source and transport beam-line for radioactive ions will improve efficiency and reliability when it begins commissioning in FY 2010.
  - The **Fundamental Neutron Physics Beamline** at the Spallation Neutron Source, which is scheduled to be completed in FY 2010, will provide high intensity pulsed beams of cold and ultracold neutrons for fundamental research with neutrons. A new external building as part of the facility will accommodate precision instrumentation to measure the electric dipole moment of the neutron. ORNL staff plays the lead role in the fabrication of the neutron electric dipole moment experiment, which could lead to the discovery of new physics beyond the Standard Model.
  - The **National Isotope Data Center** (NIDC) is located at ORNL and is a virtual full service organization that supports all isotope development and production sites in the community supported by NP. NIDC coordinates the production, sales, and distribution of isotopes across the Nation, and the development and coordination of a suite of community outreach efforts.

- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure at ORNL. SLI is currently funding construction of a new chemical and material sciences facility under the Modernization of Laboratory Facilities project. Final funding for this project was provided in FY 2009.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues. Protective force services are provided under a contract with the Oak Ridge Office.

Oak Ridge National Laboratory Site Office

The Oak Ridge National Laboratory Site Office provides the single federal presence with responsibility for contract performance at ORNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Oak Ridge Office

The Oak Ridge (OR) Office directly provides corporate support (procurement, legal, financial management, human resources, and facilities and infrastructure) to site offices responsible for program management oversight of four major management and operating laboratories—ORNL, PNNL, SLAC, and TJNAF. The administrative, business, and technical expertise of OR is shared SC-wide through the Integrated Support Center concept. The OR Manager is also the single federal official with responsibility for contract performance at the Oak Ridge Institute for Science and Education (ORISE). The Manager provides on-site presence for ORISE with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations. OR also oversees the OR Reservation and other DOE facilities in the City of Oak Ridge. Together on the Reservation and in the City of Oak Ridge there are 35 buildings (237 thousand square feet). The average age of all the buildings is 50 years.

- **Science Laboratories Infrastructure**: The Oak Ridge Landlord subprogram maintains Oak Ridge Reservation infrastructure such as roads outside plant fences as well as DOE facilities in the town of Oak Ridge, payment in lieu of taxes (PILT), and other needs related to landlord responsibilities.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, protective force officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, and security systems. This program includes funding for SCs only category I, special nuclear materials facility, 3019.

Office of Scientific and Technical Information

The Office of Scientific and Technical Information (OSTI) fulfills the Department's legislative mandate to provide public access to the unclassified results of DOE's research programs. OSTI also collects, protects, and provides secure access to DOE's classified research outcomes. OSTI has built broad collaborations both within the U.S. and internationally to enable a single point of access to nearly 400 million pages of scientific information. Within the U.S., Science.gov offers simultaneous searching of federal science databases and websites, while WorldWideScience.org performs the same functionality across the R&D results of over 50 countries. OSTI consists of one 63 year-old building (135 thousand gross square feet of space).

- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure at OSTI.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Pacific Northwest National Laboratory

Pacific Northwest National Laboratory (PNNL) is a DOE multiprogram laboratory located in Richland, Washington that supports DOE's science, national security, energy, and homeland security missions. PNNL operates the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL)—a 224 thousand square foot national scientific user facility constructed by DOE.

- **Advanced Scientific Computing Research**: PNNL conducts research in applied mathematics and computer science, as well as research in advanced computing software tools. PNNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes that focus on specific software challenges confronting users of petascale computers.

- **Basic Energy Sciences**: PNNL supports research in interfacial and surface chemistry, inorganic molecular clusters, analytical chemistry, geosciences, and applications of theoretical chemistry. Materials research emphasizes synthesis science, mechanical properties, and radiation effects.
- **Biological and Environmental Research**: PNNL is home to EMSL, a national scientific user facility that provides integrated experimental and computational resource for discovery and technological innovation in the environmental molecular sciences. EMSL provides more than 50 leading-edge instruments and a supercomputer. EMSL enables users to undertake molecular-scale experimental and theoretical research on aerosol chemistry, biological systems, biogeochemistry, and interfacial and surface science.

  PNNL conducts a wide variety of subsurface biogeochemical research, with emphasis on the fate and transport of uranium, technetium, and plutonium. The research focuses on an integrated understanding of the coupled geochemical, microbiological, and hydrological processes that impact contaminant transport across scales in the environment. The research integrated computer modeling with experimentation to advance a predictive understanding of processes impacting contaminant mobility in the environment. PNNL manages two large field sites for integrated, multidisciplinary research on contaminant transport and leads a SciDAC effort to address computational challenges to linking models of biogeochemical processes impacting contaminant mobility at different scales.

  The Atmospheric Radiation Measurement Climate Research Facility (ACRF) technical office is located at PNNL, as is the project manager for the ACRF engineering activity; this provides invaluable logistical, technical, and scientific expertise for the program. The technical office is responsible for the development of new data products, measurement system engineering, and the conduct of aerial and ground-based field campaigns.

  PNNL provides expertise in research on aerosol properties and processes and in field campaigns for atmospheric sampling and analysis of aerosols. PNNL also conducts climate modeling research to improve the simulations of both precipitation through representation of sub-grid orography and the effect of aerosols on climate at regional to global scales. PNNL manages the Atmospheric Radiation Measurement Aerial Facility as well. PNNL also conducts research on improving atmospheric system research methods and models for assessing the costs and benefits of climate change and of various different options for mitigating and/or adapting to such changes. PNNL, in conjunction with ANL, ORNL, and six universities, plays an important role in the Carbon Sequestration in Terrestrial Ecosystems (CSiTE) consortium, focusing on the role of soil microbial processes in carbon sequestration. PNNL also conducts research on the integrated assessment of global climate changes. It also is the task lead for studying mega-droughts in the LBNL-led multi-laboratory effort on Abrupt Climate Change.

  PNNL is one of the major national laboratory partners that support the JGI, the principal goal of which is high-throughput DNA sequencing. One of PNNL's roles in the JGI involves proteomics research (identifying all the proteins found in cells). PNNL conducts research on the molecular mechanisms of cell responses to low doses of radiation and the development of high-throughput approaches for characterizing all of the proteins (the proteome) being expresses by cells under specific environmental conditions. PNNL conducts microbial systems biology research as part of Genomic Science.
- **Fusion Energy Sciences**: PNNL has focused on research on materials that can survive in a fusion neutron environment. Scientists and engineers at PNNL provide leadership in the evaluation of

ceramic matrix composites for fusion applications and support work on ferrite steels as part of the U.S. fusion materials team.

- **Nuclear Physics**: NP supports modest R&D efforts aimed at exploring production mechanisms for isotopes, and for the processing of select isotopes important to the U.S. NP also supports R&D efforts towards a next generation detector to search for neutrinoless double beta decay.
- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure at PNNL. The SLI program is currently funding construction of the new Physical Sciences Facility. Funding for this project was completed in FY 2009.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues. Protective force services are provided under a memorandum of understanding with the Department's Office of Environmental Management.

Pacific Northwest Site Office

The Pacific Northwest Site Office provides the single federal presence with responsibility for contract performance at PNNL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Princeton Plasma Physics Laboratory

Princeton Plasma Physics Laboratory (PPPL) is a program-dedicated laboratory located on 88 acres in Plainsboro, New Jersey. The laboratory consists of 34 buildings (754 thousand gross square feet of space). The average age of the buildings is 36 years.

- **Advanced Scientific Computing Research**: PPPL participates in SciDAC science application teams related to fusion science.
- **Fusion Energy Sciences**: PPPL is the only DOE laboratory devoted primarily to plasma and fusion science. The laboratory hosts experimental facilities used by multi-institutional research teams and also sends researchers and specialized equipment to other fusion facilities in the United States and abroad. PPPL is the host for the National Spherical Torus Experiment (NSTX), which is an innovative toroidal confinement device, closely related to the tokamak. PPPL scientists and engineers have significant involvement in the DIII-D and Alcator C-Mod tokamaks and the NSF Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas, as well as several large tokamak facilities abroad, including the Joint European Torus in the United Kingdom, and the Korean Superconducting Tokamak Reactor Advanced Research in Korea. Research is focused on developing the scientific understanding and innovations required for an attractive fusion energy source. PPPL is a partner with ORNL in the U.S. Contributions to ITER Project with responsibility for design and fabrication of various plasma diagnostics and ITER's steady-state electric power system. PPPL scientists are also involved in several basic plasma science experiments, ranging from magnetic reconnection to plasma processing. PPPL has a large theory group that does research in the areas of turbulence and transport, equilibrium and stability, wave-plasma interaction, and heavy ion accelerator physics. PPPL, LBNL, and LLNL currently work together in advancing the physics of heavy ion drivers for research in high energy density laboratory plasmas through the Heavy Ion Fusion Science Virtual National Laboratory. Through its association with Princeton University, PPPL provides high quality education in fusion-related sciences, having produced more than 230 Ph.D. graduates since its founding in 1951.

- **High Energy Physics**: HEP supports a small theoretical research effort at PPPL using unique capabilities of the laboratory in the area of advanced accelerator R&D.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Princeton Site Office

The Princeton Site Office provides the single federal presence with responsibility for contract performance at PPPL. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Sandia National Laboratories

Sandia National Laboratories (SNL) is a multiprogram laboratory located on 3,700 acres in Albuquerque, New Mexico, with additional sites in Livermore, California and Tonopah, Nevada.

- **Advanced Scientific Computing Research**: SNL conducts research in applied mathematics and computer science, as well as research in advanced computing software tools. SNL also participates in several SciDAC science application teams and both SciDAC Centers for Enabling Technologies and SciDAC Institutes, which focus on specific software challenges confronting users of petascale computers.
- **Basic Energy Sciences**: SNL is home to significant research efforts in materials and chemical sciences with additional programs in geosciences. SNL has a historic emphasis on electronic components needed for the Office of Defense Programs. The laboratory has very modern facilities in which unusual microcircuits and structures can be fabricated out of various semiconductors. It is also the site of the Center for Integrated Nanotechnologies (CINT).
  - The **Center for Integrated Nanotechnologies** is devoted to establishing the scientific principles that govern the design, performance, and integration of nanoscale materials. Through its core facility in Albuquerque, New Mexico, and its gateways to both SNL and LANL, CINT provides access to tools and expertise to explore the continuum from scientific discovery to the integration of nanostructures into the microworld and the macroworld. CINT supports five scientific thrusts that serve as synergistic building blocks for integration research: nano-bio-micro interfaces, nanophotonics and nanoelectronics, complex functional nanomaterials, nanomechanics, and theory and simulation.
- **Biological and Environmental Research**: In support of BER's climate change research, SNL provides the site manager for the North Slope of Alaska ACRF site, who is responsible for day-to-day operations at that site. In addition, SNL conducts climate modeling research on modifying the Community Atmospheric Model to support new dynamical cores and improve its scalability for implementation on high-system computing systems. SNL is a partner in the LBNL-led Joint BioEnergy Institute.
- **Fusion Energy Sciences**: SNL plays a lead role in developing components for fusion devices through the study of plasma interactions with materials, the behavior of materials exposed to high heat fluxes, and the interface of plasmas and the walls of fusion devices. Material samples and prototypes are tested in SNL's Plasma Materials Test Facility, which uses high-power electron beams to simulate the high heat fluxes expected in fusion environments. Materials and components are

exposed to tritium-containing plasmas in the Tritium Plasma Experiment located in the STAR facility at INL. Sandia supports a wide variety of domestic and international experiments in the areas of tritium inventory removal, materials postmortem analysis, diagnostics development, and component design and testing. SNL serves an important role in the design and analysis activities related to the ITER first wall components, including related R&D.

Savannah River National Laboratory

The Savannah River National Laboratory (SRNL) is a multiprogram laboratory located on approximately 34 acres in Aiken, South Carolina. SRNL provides scientific and technical support for the site's missions, working in partnership with the site's operating divisions. The laboratory is a partner with ORNL in the U.S. Contributions to ITER Project with responsibility for design and fabrication of ITER's tokamak exhaust processing system.

- **Biological and Environmental Research**: SRNL scientists support environmental remediation sciences research program in the area of subsurface contaminant fate and transport.

SLAC National Accelerator Laboratory

The SLAC National Accelerator Laboratory is located on 426 acres of Stanford University land in Menlo Park, California. SLAC is a multipurpose laboratory for photon science, accelerator and particle physics research and astrophysics. SLAC operates the final third of its two mile linear accelerator for the Linac Coherent Light Source (LCLS). SLAC consists of 161 buildings (1.9 million gross square feet of space). The average age of all the buildings is 30 years.

- **Basic Energy Sciences**: SLAC is home to research activities in materials and chemical sciences that build on ultrafast and advanced synchrotron techniques and include an emphasis on materials for energy. It is the site of two user facilities—the Linac Coherent Light Source (LCLS) and the Stanford Synchrotron Radiation Light source (SSRL).
  - The **Linac Coherent Light Source** is a user facility that provides laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source. The SLAC linac will provide high-current, low-emittance 5–15-GeV electron bunches at a 120 hertz repetition rate. A long undulator bunches the electrons and leads to self-amplification of the emitted x-ray radiation at the LCLS, which constitutes the world's first free electron laser user facility producing short pulses (from a few to 200 femtoseconds long) in the hard and soft x-ray regions. The x-ray laser light is utilized at several instruments located at six hutches to perform experiments in many areas of physics, chemistry, and biology.
- The **Stanford Synchrotron Radiation Light Source** is a DOE user facility for researchers from industry, government laboratories, and universities. These include astronomers, biologists, chemical engineers, chemists, electrical engineers, environmental scientists, geologists, materials scientists, and physicists. A research program is conducted at SSRL with emphasis in both the x-ray and ultraviolet regions of the spectrum. SSRL scientists are experts in photoemission studies of high-temperature superconductors and in x-ray scattering. The SPEAR 3 upgrade at SSRL provided major improvements that increase the brightness of the ring for all experimental stations. **Advanced Scientific Computing Research**: SLAC participates in SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data.
- **Biological and Environmental Research**: SLAC operates nine SSRL beamlines for structural molecular biology. This program involves synchrotron radiation-based research and technology

developments in structural molecular biology that focus on protein crystallography, x-ray small angle scattering diffraction, and x-ray absorption spectroscopy for determining the structures of complex proteins of many biological consequences. Beamlines at SSRL also support a environmental science user community.

SLAC also investigates the fundamental molecular scale mechanisms controlling the stability and fate of metal and radionuclide contaminants in the subsurface at DOE sites.

- **High Energy Physics**: From 1999 to 2008, SLAC operated the **B-factory**, consisting of PEP-II, a high energy asymmetric electron-positron collider, and BaBar, a multi-purpose detector, for high-precision studies of CP symmetry violation in the B meson system. The BaBar collaboration is engaged in the analysis of the full data set collected at the B-factory over its nine years of operations. High precision results on CP violation, the parameters of the Standard Model, and the masses and properties of new heavy quark states are being accumulated and published. Ramp-down and decommissioning and decontamination activities started in FY 2009 and will continue for a number of years.

  SLAC participates in the research program of the ATLAS detector at the LHC, and is also working at the Cosmic Frontier of particle astrophysics. SLAC led construction of the primary instrument for the Fermi Gamma-ray Space Telescope (FGST) which was launched into earth orbit in 2008, and is home to the data operations center that manages the scientific data collection from the satellite. SLAC physicists and a user community will analyze the FGST data for several years. SLAC is leading the R&D for a camera to be used in the proposed Large Synoptic Survey Telescope, which is a next-generation ground-based dark energy experiment. SLAC and Stanford University are also home to the Kavli Institute for Particle Astrophysics and Cosmology, which brings together researchers studying a broad range of fundamental questions about the universe, from theoretical astrophysics to dark matter and dark energy. HEP supports research at Kavli aimed primarily at exploring astrophysical phenomena to test new ideas in particle physics.

  SLAC is a major contributor to the leadership and development of advanced accelerator technologies. The laboratory is at the forefront of damping ring and beam delivery designs, required to ensure the beam brightness and precision control needed for future accelerators. SLAC also represents the center of expertise for design, fabrication, and testing of radio frequency power systems used to energize the accelerator components. The laboratory also participates in R&D for advanced detector technologies, with emphasis on software, simulation, and electronics.

- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure and remove excess facilities at SLAC. The SLI program is currently funding the Research Support Building and Infrastructure Modernization project at SLAC to replace substandard modular buildings and trailers that are well beyond their intended useful life, and to modernize key existing buildings onsite.

- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

SLAC Site Office

The SLAC Site Office provides the single federal presence with responsibility for contract performance at SLAC. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Thomas Jefferson National Accelerator Facility

Thomas Jefferson National Accelerator Facility (TJNAF) is a Nuclear Physics program-dedicated laboratory located on 206 acres in Newport News, Virginia, focused on the exploration of nuclear and nucleon structure. The laboratory consists of 63 buildings (685 thousand gross square feet of space). The average age of the buildings is 18 years.

- **Advanced Scientific Computing Research**: TJNAF participates in SciDAC science application teams relevant to physics research, accelerator modeling, and distributed data.
- **Biological and Environmental Research**: BER supports the development of advanced imaging instrumentation at TJNAF that will ultimately be used in the next generation biological imaging systems.
- **High Energy Physics**: HEP supports an R&D effort at TJNAF on accelerator technology, using the unique expertise of the laboratory in the area of superconducting radiofrequency systems for particle acceleration.
- **Nuclear Physics**: The centerpiece of TJNAF is the **Continuous Electron Beam Accelerator Facility** (CEBAF), a unique international electron-beam user facility for the investigation of nuclear and nucleon structure based on the underlying quark substructure. The facility has an international user community of about 1,430 researchers. Polarized electron beams with energies of up to 5.7 GeV can be provided by CEBAF simultaneously to three different experimental halls. Hall A is designed for spectroscopy and few-body measurements. Hall B has a large acceptance detector, CLAS, for detecting multiple charged particles coming from a scattering reaction. Hall C is designed for flexibility to incorporate a wide variety of different experiments. Its core equipment consists of two medium resolution spectrometers for detecting high momentum or unstable particles. Also in Hall C, a new detector, Q-weak, is being fabricated to measure the weak charge of the proton by a collaboration of laboratory and university groups, in partnership with the NSF. TJNAF supports a group that does theoretical calculations and investigations in subjects supporting the experimental research programs in medium energy physics. TJNAF research and engineering staff are world experts in superconducting radiofrequency accelerator technology. Their expertise is being used in the construction of the 12 GeV CEBAF Upgrade Project, which started construction in FY 2009 and received funding to mitigate project risks under the Recovery Act. In addition to upgraded capability at the existing Halls A, B, and C, the project will construct a new Hall D, and will provide researchers with the opportunity to study quark confinement, one of the greatest mysteries of modern physics.
- **Science Laboratories Infrastructure**: SLI funds line item construction to maintain the general purpose infrastructure and remove excess facilities at TJNAF. The SLI program currently funds two projects at TJNAF. The first is the Technology and Engineering Development Facility project that will construct new industrial assembly, laboratory, and office space, and renovate existing space in the Test Lab Building. The second, the Utility Infrastructure Modernization project, will upgrade the power distribution, cooling water, and communications systems.
- **Safeguards and Security**: This program provides planning, policy, implementation, and oversight in the areas of program management, access control officers, and information security. In addition, the Safeguards and Security program addresses the full range of cyber, personnel security, security systems, and material control and accountability issues.

Thomas Jefferson Site Office

The Thomas Jefferson Site Office provides the single federal presence with responsibility for contract performance at TJNAF. This site office provides an on-site SC presence with authority encompassing contract management, program and project implementation, federal stewardship, and internal operations.

Washington Headquarters

SC Headquarters, located in the Washington, D.C. area, is responsible for the Federal funds awarded to about 300 universities, all 17 DOE national laboratories, and private research institutions. HQ Program and Project Managers are responsible for scientific program development and management across a broad spectrum of scientific disciplines and program offices, as well as oversight of the design, construction, and operation of large-scale scientific user facilities at laboratories and universities. Program management and oversight includes regular rigorous evaluation of research programs, facilities, and projects by external peer review. Additional HQ policy, technical, and administrative support staff are responsible for budget and planning; general administration; information technology; infrastructure management; construction management; safeguards and security; and environment, safety, and health within the framework set by the Department.

Waste Isolation Pilot Plant

The Waste Isolation Pilot Plant is a deep geologic repository for the permanent disposal of radioactive waste and is located in Eddy County in southeastern New Mexico, 26 miles southeast of Carlsbad.

Advanced Scientific Computing Research

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Advanced Scientific Computing Research				
Mathematical, Computational, and Computer Sciences Research	150,373	+37,130	163,792	165,091
High Performance Computing and Network Facilities	208,399	+124,665	230,208	260,909
Total, Advanced Scientific Computing Research	358,772[b]	+161,795	394,000	426,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 108–423, "Department of Energy High-End Computing Revitalization Act of 2004"
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The mission of the Advanced Scientific Computing Research (ASCR) program is to discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to the Department of Energy (DOE). A particular challenge of this program is fulfilling the science potential of emerging multi-core computing systems and other novel "extreme-scale" computing architectures, which will require significant modifications to today's tools and techniques.

Background

Imagine exploring the inner workings of a supernova or traveling through time to observe Earth's global climate as it changes. Scientists today can explore these realms thanks to a 100 fold increase in computing power delivered over the past five years and to the software developed to harness the power of these forefront computers.

Throughout history, as we have strived to comprehend the mysteries of the universe, mathematics has been an essential tool. It allowed Pythagoras to determine the diameter of the earth. Newton and Leibniz invented calculus to understand the movement of the planets. Mathematical research in the 1800s led to Einstein's Theory of General Relativity.

While mathematics enabled the study of increasingly complex problems, the time to carry out these calculations became unmanageable. Today, advances in mathematics and computing enable scientists to gain new insights into societal concerns such as Alzheimer's disease and climate change. ASCR and its predecessor programs have led these advances for the past thirty years.

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] Total is reduced by $10,048,000: $8,972,000 of which was transferred to the Small Business Innovation Research (SBIR) program and $1,076,000 of which was transferred to the Small Business Technology Transfer (STTR) program.

In FY 2009, ASCR delivered petascale computing power to the open science community and two of the world's fastest computers for open-science. These machines enabled two Gordon Bell prizes, including the world's first petascale application, and swept the High Performance Computing challenge at SuperComputing08—an international conference on high performance computing with about 11,000 participants and a technical program that has included breakthroughs in many areas and inspired new and innovative areas of computing. At SuperComputing09, ASCR's Oak Ridge Leadership Computing Facility topped the list of the "Top 500" computers in the world and added another Gordon Bell prize. Since the machines are open to all on a competitive basis, the scientific applications span a variety of topics such as: flame simulation to guide design of fuel-efficient clean engines, high temperature superconductivity, supernova shock wave instability, designing proteins at atomic scale, and creating enzymes.

Computational scientists create mathematical models and simulations of physical, biological, and chemical phenomena, which allow them to better understand the phenomena and to predict behavior. In the case of climate change, there is a growing demand for the development of tools that will help inform decision makers on the options for addressing and adapting to a changing climate. Waiting for the observation and recording of the impacts of increasing concentrations of greenhouse gases is not sufficient. With computation and simulation, scientists can model what is known about the Earth's systems, identify uncertainties of the models, and determine the observational data and experiments needed to further refine and improve the models. Improved climate models will allow scientists to predict, with greater confidence, future changes in the climate under various scenarios. These modeling efforts can help identify potential mitigation strategies.

ASCR supports basic research in both applied mathematics and computer science focused in areas relevant to high performance computing. The results of this research are brought to the broader scientific communities through the Scientific Discovery through Advanced Computing (SciDAC) program. SciDAC facilitates the transfer basic research efforts into computational science applications through direct partnerships between ASCR-supported applied mathematicians and computer scientists, and domain experts in a specific discipline supported by other Office of Science (SC) programs, such as climate, astrophysics, materials, or fusion. These partnerships have been spectacularly successful with documented improvements in code performance in excess of 10,000 percent.

Researchers have a need to communicate with each other, exchange large data sets, and run complex calculations and experiments in remote scientific user facilities. To facilitate the best collaborations for science, ASCR has had a leading role in driving development of the networks connecting these researchers. Today, the invisible glue that binds all the networks in the world together and effortlessly passes billions of searches and trillions of bits has roots in ASCR research. ASCR researchers helped to establish critical protocols such as TCP/IP on which the current Internet is based. ASCR advanced networking research also makes international collaborations such as the Large Hadron Collider and ITER possible. The Internet has removed barriers between people and ASCR's advanced scientific networks have removed barriers between scientists and research facilities.

Looking forward, ASCR will continue to be guided by science needs as it develops computers and networks at the leading edge of technology. The ASCR approach of integrating research results across disciplines and with forefront facilities has been the key to its history of success in computational science. With this integrated approach ASCR will continue to deliver scientific insight to address national problems in energy and the environment.

Subprograms

To accomplish its mission and address the challenges described above, the ASCR program is organized into two subprograms—Mathematical, Computational, and Computer Sciences Research and High Performance Computing and Network Facilities.

- The *Mathematical, Computational, and Computer Sciences Research* subprogram develops mathematical descriptions, models, methods, and algorithms to describe and understand complex systems, often involving processes that span a wide range of time and/or length scales. The subprogram also develops the software to make effective use of advanced networks and computers, many of which contain thousands of multi-core processors with complicated interconnections, and to transform enormous data sets from experiments and simulations into scientific insight.
- The *High Performance Computing and Network Facilities* subprogram delivers forefront computational and networking capabilities and contributes to the development of next-generation capabilities through support of prototypes and testbeds.

Effective scientific utilization of high-end capability computing requires dynamic partnerships among application scientists, applied mathematics, computer scientists, and facility support staff. Therefore, close coordination both within and across ASCR subprograms and with partner organizations is key to the success of the ASCR program.

Benefits

Computer-based simulations enable us to model the behavior of complex systems that are beyond the reach of experiment or for which there is no theory. Because computer-based simulation is so important to research programs across SC and throughout the government, in addition to its core research program, ASCR invests in partnerships to advance use of high end computing in a wide array of disciplines important to DOE and operates the Leadership Computing Facilities as open user facilities with access determined by merit evaluation of proposals.

Many of the applications running on ASCR facilities have direct benefit to science and society at large. For example, SciDAC efforts include:

- Computational chemistry and simulation of nanomaterials is relevant to energy applications. These applications are funded in partnership with the Basic Energy Sciences program.
- The next generation Earth System Models will dramatically improve our ability to predict changes in global climate. This work is funded in partnership with the Biological and Environmental Research program. ASCR also provides the majority of the computing and networking resources for the U.S. contributions to the Intergovernmental Panel on Climate Change.
- Simulations of fusion reactors help to develop fusion as a viable energy source. This work is jointly funded with the Fusion Energy Sciences program.
- Computer modeling of nuclear structure has relevance for science, nuclear energy, and nuclear weapons. These applications are through partnerships with both the Nuclear Physics program and the National Nuclear Security Administration.
- Understanding the origin and fate of the universe is the goal of partnerships with the High Energy Physics program that include analyzing massive amounts of data from experiments, such as the Large Hadron Collider, and conducting simulations, such as three dimensional simulations of supernovae events, which are only possible with leadership computing resources.

- Simulations of biological systems relevant for bioenergy applications and subsurface science research characterizes and predicts changes in DOE's environmental management sites. This work also has implications for DOE's efforts in subsurface carbon sequestration. These applications are partnerships with the Biological and Environmental Research Program.

Establishing SC Leadership Computing Facilities has required partnerships with hardware vendors to develop the most appropriate architectures for scientific discovery and the software necessary to effectively use these powerful systems. These partnerships benefit many sectors of the economy from high-tech industry and academic research to software development and engineering. Finally, ASCR's support of researchers and students (the next generation of researchers) is a benefit to the national research and development workforce.

Program Planning and Management

The ASCR program has developed a system of planning and priority setting that benefits strongly from groups of outside experts. ASCR has also instituted a number of peer review and oversight processes designed to assess the quality, relevance, and performance of the ASCR portfolio on a regular basis. One way in which ASCR ensures the integrity and effectiveness of the peer review processes is through the Advanced Scientific Computing Advisory Committee (ASCAC), which organizes regular Committees of Visitors to review ASCR research management, the impact of the ASCR scientific user facilities, and progress toward the long-term goals of the program. In addition, ASCAC identifies scientific challenges and opportunities, including specific bottlenecks to progress in areas such as climate change or computational biology, and comments on the overall balance of the ASCR portfolio.

In addition to ASCAC, critical tools for managing the ASCR scientific user facilities include annual operational reviews and requirements workshops. For example, ESnet conducts two network requirements workshops per year with individual SC program offices. The purpose of each workshop is to accurately characterize the near-term, medium-term, and long-term network requirements of the science conducted by each program office. Since two workshops are conducted per year, ASCR refreshes the network requirements information for each of the six program offices every three years.

Community-driven workshops are another critical means by which dialogues are facilitated and new research opportunities are identified. For example, there were a series of workshops in 2009 to identify key science opportunities in the disciplines important to DOE—nuclear energy, materials and chemistry, high energy and nuclear physics, climate change, biology, and cross-cutting areas—and the potential role of extreme scale computing in realizing those opportunities.

Another important planning and coordination mechanism for ASCR is the National Science and Technology Council's (NSTC) subcommittee on Networking and Information Technology Research and Development (NITRD). ASCR is a major participant in the NITRD program[a], which coordinates Federal research investments by the 11 member agencies in advanced information technologies such as computing, networking, and software through interagency working groups and coordinating groups. ASCR is a major participant and/or chair of the High End Computing Research and Development, Large Scale Networking, and High End Computing Infrastructure and Applications groups.

In October 2008, the National Research Council published a study titled "The Potential Impact of High-End Capability Computing (HECC) on Four Illustrative Fields of Science and Engineering"[b] that identifies and categorizes important scientific questions and technology problems for which an extraordinary advancement in our understanding is difficult or impossible without leading edge scientific simulation capabilities. In all four fields studied—atmospheric sciences, astrophysics, separations chemistry, and evolutionary biology—the committee found continuing demand for more powerful high end computing and for large scale data management. The report outlined the major scientific challenges in the four fields and estimated the associated challenges in mathematics, computer science, and computing infrastructure. The conclusions of the report underscore the importance of balancing investments in high potential application areas, the high-end computing resources required by multiple fields, and the longer-term mathematics and computer science research that underpins continued progress. The report also emphasizes the added importance of linking these efforts: "In many cases HECC capabilities must continue to be advanced to maximize the value of data already collected...The committee foresees a growing need for computational scientists and engineers who can work with mathematicians and computer scientists to develop next-generation code."

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[a] Information on the NITRD program can be found at http://www.nitrd.gov.

[b] The "The Potential Impact of High-End Capability Computing (HECC) on Four Illustrative Fields of Science and Engineering" can be found at http://www.nap.edu/catalog.php?record_id=12451

Basic and Applied R&D Coordination

A cornerstone of the ASCR program is coordination across disciplines and programs. Partnerships within SC are mature and continue to advance the use of high performance computing and scientific networks for science. In addition, ASCR continues to have a strong partnership with the National Nuclear Security Administration in areas of mutual interest including best practices for management of high performance computing facilities. Through NITRD, ASCR coordinates with similar programs across the federal government and directly partners with the Department of Defense on developing High Productivity Computing Systems and software and with the National Science Foundation on the Open Science Grid.

In discussions with the technology development programs throughout DOE, a key area of mutual interest continues to be in applied mathematics for the optimization of complex systems, control theory, and risk assessment. In March 2009, a workshop was organized, in partnership with the Office of Electricity Delivery and Energy Reliability, which focused on the challenges of grid modernization efforts. This workshop is part of a series of workshops on basic research needs in applied R&D areas. Other workshops have covered advanced nuclear energy systems (with the Office of Nuclear Energy), subsurface science (with the Offices of Environmental Management, and Fossil Energy), cyber security (with the Office of Electricity Delivery and Energy Reliability), and alternative and renewable energy (with the Office of Energy Efficiency and Renewable Energy). These workshops facilitate a dialogue between the ASCR research community and a specific applied R&D community and identify opportunities for new research. This research becomes part of the ASCR program through investigator driven research proposals and is coordinated with the applied efforts through program manager interactions and joint principal investigator meetings.

Budget Overview

The FY 2011 ASCR budget request capitalizes on the continued gains in computer hardware and in computational science and positions DOE to address scientific challenges through modeling and simulation in the next decade. Since the challenges ahead will require major advances in hardware, software, methods, and tools, the request balances investments in high performance computing facilities, advanced networks, and research and evaluation prototypes with investments in applied mathematics, computer science, next generation networks for science, and computational partnerships. This balance should allow for continued progress in a wide array of fields important to DOE's missions in FY 2011 and for years to come.

The FY 2011 budget request continues support for the Leadership Computing Facility at Oak Ridge National Laboratory (OLCF)—a 2.33 petaflop, six-core Cray Baker system, openly available to the scientific community through the Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program. In addition to INCITE projects, the OLCF will continue to provide access and assistance to tool and library developers and to researchers seeking to scale their application to this new realm of computing power. These activities are critical to harnessing the complexity of this architecture and meeting challenges associated with high performance computer systems with tens of thousands of multicore processors. Efforts at the OLCF are also expected to build experience and tools for the DARPA High Productivity Computing Systems award to Cray, supported in part through ASCR's Research and Evaluation Prototypes activity, and other anticipated architectures that will exhibit even greater complexity.

The FY 2011 budget request also continues support for the Leadership Computing Facility at Argonne National Laboratory (ALCF)—a 556 teraflop IBM Blue Gene/P system also openly available to the scientific community through INCITE. Like the OLCF, the ALCF will continue to provide access and assistance to tool and library developers and to researchers seeking to scale their applications. The FY 2011 budget request also includes site preparation and acquisition activities for a next generation machine of approximately10 petaflops. Development of this proposed machine is based on the joint ASCR-NNSA sponsored research project with IBM and the Argonne and Lawrence Livermore National Laboratories that was supported from FY 2006 to FY 2010 through the Research and Evaluations Prototypes activity.

The National Energy Research Scientific Computing Center (NERSC) facility at Lawrence Berkeley National Laboratory (LBNL) will operate at a capacity of nearly one petaflop in FY 2011 to meet ever growing demand from SC researchers. Focus will be on assisting applications to effectively utilize the potential of this facility and to move beyond NERSC to the leadership computing machines.

The FY 2011 budget request supports ESnet to continue to advance the next generation network capability that is critical to DOE applications and facilities. Building on the Recovery Act-supported Advanced Networking Initiative, ESnet will deliver 100–400 gigabit per second (Gbps) connections to SC laboratories in FY 2011, with a goal of achieving 1,000 Gbps connectivity in 2014. These increases in bandwidth are necessary to move massive amounts of data to and from the petascale computing facilities and from other research facilities such as the Large Hadron Collider and Spallation Neutron Source. The ESnet is also critical to effective utilization of the growing amounts of data in climate research, nuclear structure, genomics, and proteomics that advance DOE's energy and environment missions.

The FY 2011 budget continues the research efforts in Scientific Discovery through Advanced Computing (SciDAC) and the core research programs in Applied Mathematics and Computer Science that enable scientists to effectively utilize the capabilities of the Leadership Computing Facilities while beginning to lay the basic research foundation necessary to realize the potential from the more complex systems on the horizon. Core research in Applied Mathematics and Computer Science for FY 2011 will continue to focus on long-term research needs. In networking, the focus will continue to be on developing the advanced tools to harness the growing capabilities and requirements of the ESnet and the SC research community.

Significant Program Shifts

The demands of some critical science applications require us to look ahead to more advanced computing architectures. In FY 2010, ASCR launched a new computer science core research effort in advanced computing architectures. The FY 2011 budget enhances this effort with new projects in the Research and Evaluations Prototypes activity that replace completed projects. These projects will provide the ASCR research community with an opportunity to experiment with cutting-edge architectures and begin to develop tools and methods for harnessing their capabilities. Physical limits to miniaturization necessitate a period of innovation and collaboration for continued progress to be realized. By actively participating in the development of these next-generation machines, ASCR can ensure that the most appropriate architecture for science is developed while researchers better understand their inherent challenges and can begin to work on overcoming those challenges. This activity will prepare researchers to effectively utilize the next generation of scientific computers and will also reduce the risk of future major procurements.

In FY 2011, SciDAC will be expanded to include partnerships with DOE's applied technology offices such as the Office of Electricity Delivery and Energy Reliability and the Office of Nuclear Energy.

Annual Performance Targets and Results

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering

GPRA Unit Program Goal: Advanced Scientific Computing Research Program Goal: Deliver forefront computational and networking capabilities—Deliver forefront computational and networking capabilities to scientists nationwide that enable them to extend the frontiers of science, answering critical questions that range from the function of living cells to the power of fusion energy.

Annual Performance Measure: Average annual percentage increase in the computational effectiveness (either by simulating the same problem in less time or simulating a larger problem in the same time) of a subset of application codes, tools and/or libraries.

FY 2006	T: Computational effectiveness is greater than 50%. A: Goal met
FY 2007	T: Achieved computational effectiveness is 100% or greater. A: Goal met
FY 2008	T: Achieved computational effectiveness is 100% or greater. A: Goal met
FY 2009	T: Achieved computational effectiveness is 100% or greater. A: Goal met
FY 2010- FY 2015	T: Achieved computational effectiveness is 100% or greater. A: TBD

Annual Performance Measure: Focus usage of the primary supercomputer at the National Energy Research Scientific Computing Center (NERSC) on capability computing.

FY 2006	T: Percentage of the computing time used that is accounted for by computations that require at least $^{1}/_{8}$ of the total resource is at least 40%. A: Goal met

FY 2007	T: Percentage of the computing time used that is accounted for by computations that require at least $^{1}/_{8}$ of the total resource is at least 40%. A: Goal met
FY 2008	T: Thirty percent (30%) of the computing time will be used by computations that require at least $^{1}/_{8}$ (2,040 processors) of the NERSC resource. A: Goal met
FY 2009	T: At least forty percent (40%) of the computing time will be used by computations that require at least $^{1}/_{8}$ (2,040 processors) of the NERSC resource. A: Goal met
FY 2010	T: At least 30% of the computing time will be used by computations that require at least $^{1}/_{8}$ (4,096 processors) of the NERSC resource. A: TBD
FY 2011	T: At least 30% of the computing time will be used by computations that require at least $^{1}/_{8}$ of the NERSC resource. A: TBD
FY 2012	T: At least 35% of the computing time will be used by computations that require at least $^{1}/_{8}$ of the NERSC resource. A: TBD
FY 2013- FY 2015	T: At least 40% of the computing time will be used by computations that require at least $^{1}/_{8}$ of the NERSC resource. A: TBD

Mathematical, Computational, and Computer Sciences Research
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Mathematical, Computational, and Computer Sciences Research			
Applied Mathematics	45,161	44,792	45,450
Computer Science	30,782	46,800	47,400
Computational Partnerships	59,698	53,293	53,297
Next Generation Networking for Science	14,732	14,321	14,321
SBIR/STTR	0	4,586	4,623
Total, Mathematical, Computational, and Computer Sciences Research	150,373	163,792	165,091

Description

The Mathematical, Computational, and Computer Sciences Research subprogram supports elements of the ASCR program aimed at effectively utilizing forefront computational and networking capabilities. Computational science is increasingly central to progress at the frontiers of science and to our most challenging feats of engineering. Accordingly, the subprogram must be positioned to address scientifically challenging questions, such as:

- What new mathematics are required to more accurately model systems such as the earth's climate and the behavior of living cells that involve processes taking place on vastly different time and/or length scales?
- Which computational architectures and platforms will deliver the most benefit for the science of today and the future?
- What innovations in computer science and algorithms are needed to increase the efficiency with which supercomputers solve problems?
- What operating systems, data management, analyses, representation model development, user interfaces, and other tools are required to make effective use of future-generation supercomputers?
- What tools are needed to make all scientific resources readily available to scientists, regardless of whether they are at a university, national laboratory, or industrial setting?

FY 2009 Accomplishments

- *ASCR Research wins R&D 100 Awards.* Winning a R&D 100 award, often dubbed the "Oscars of invention," provides a mark of excellence known to industry, government, and academia for one of the most innovative ideas of the year. In FY 2009, ASCR-supported research in mathematical libraries and software toolkits, compiler development, and operating systems garnered three of these coveted awards in the software category—PETSc, a suite of data structures and routines for the scalable (parallel) solution of partial differential equation; ROSE, a compiler infrastructure that radically changes the accessibility of compiler technologies and enables users to build their own tools and easily develop programs for today's fast changing hardware platform; and the Catamount

N-Way lightweight kernel, an operating system that leverages hardware capabilities of multicore processors to deliver significant improvements in data access performance for today's parallel computing applications. (The Catamount team is supported by ASCR and builds on work previously supported by the NNSA Advanced Simulation and Computing program.)

- *41 DOE-Affiliated Researchers Named SIAM Fellows.* The Society for Industrial and Applied Mathematics (SIAM) announced its first class of fellows on May 1, 2009, and the group included 14 current and retired mathematicians from DOE national laboratories, as well as 27 other mathematicians supported by ASCR. This represents about 20 percent of the 200 fellows selected by the society from its international membership of more than 12,000 mathematicians.
- *New General Model for Detecting MPI Deadlocks Developed.* The Message Passing Interface (MPI) standard enables massively parallel processing by directing communications between processors. However, several usage patterns can lead to deadlocks and cause programs to fail. Deadlocks are particularly troublesome because they occur inconsistently and sporadically. They are also very hard to find and fix—especially in long and complicated programs. However, ASCR researchers have developed the first general deadlock model using a graph-based approach. This model enables visualization of MPI deadlocks and motivates the design of a new deadlock detection mechanism. Overall, the results demonstrate that the mechanism improves performance by as much as two orders of magnitude while providing precise characterization of deadlocks.
- *Scaling of Multimillion-Atom Biological Molecular Dynamics Simulation on a Petascale Supercomputer.* ASCR researchers published a strategy enabling molecular dynamics simulations of lignocellulosic biomass to scale to tens of thousands of processors at the OLCF. The strategy enabled the researchers to scale efficiently to the entire machine (140,000 processors). This work will have a significant impact on a wide array of molecular dynamics simulations. Among other applications, the strategy will be of particular importance in bioenergy research.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Applied Mathematics	**45,161**	**44,792**	**45,450**

The Applied Mathematics activity supports the research, development, and application of applied mathematical models, methods and algorithms to understand complex physical, chemical, biological, and engineered systems related to DOE's mission. The research falls into eight general categories, the first five of which have been supported for a number of years while the rest began in FY 2009

- Numerical methods research for equations related to problems such as wave propagation, electrodynamics, fluid flow, elasticity, and other natural or physical processes.
- Advanced linear algebra research for fast and efficient numerical solutions of linear algebraic equations that often arise when simulating physical processes. Because a large fraction of the time in many simulations is spent doing this type of computation, advances here have enormous leverage across science.
- Computational meshing research for developing ways in which space can be broken up into regions—often geometrically complex—for the purposes of simulation.

- Optimization research for mathematical methods for minimizing energy or cost, finding the most efficient solutions to engineering problems, or discovering physical properties and biological configurations. This includes optimization, control, and risk assessment in complex systems with relevance for DOE missions in energy, national security, and environment.
- Multiscale mathematics and multiphysics computations for connecting the very large with the very small, the very long with the very short, and multiple physical models in a single simulation.
- Joint Applied Mathematics-Computer Science Institutes for the development of efficient new mathematical models, algorithms, libraries, and tools for next generation computers.
- Mathematics for the analysis of extremely large datasets for identifying key features, determining relationships between the key features, and extracting scientific insights.
- Mathematics of cyber security from a basic research perspective for addressing the understanding and discovery of anomalies in existing network data, modeling of large-scale networks, and understanding dynamics and emergent behavior on networks. This leverages on-going efforts in the mathematics of optimization and risk assessment in complex systems.

These mathematical models, methods, and algorithms are the fundamental building blocks for describing physical and biological systems computationally. Applied Mathematics research underpins all of DOE's modeling and simulation efforts.

In FY 2011, this activity will continue to develop new and improved applied mathematical models, methods, and algorithms to understand complex systems—including the complex computing systems on which they will run. In addition, the Computational Science Graduate Fellowship program, aimed at attracting the best graduate students in the scientific disciplines and educating them as the next generation of computational scientists, is continued at $6,000,000, and the Applied Mathematics and High Performance Computer Science graduate fellowship program is continued at $2,000,000.

	FY 2009	FY 2010	FY 2011
Computer Science	**30,782**	**46,800**	**47,400**

The Computer Science activity supports research to utilize computing at extreme scales and to understand extreme scale data from both simulations and experiments. The research falls into five general categories, the first four of which have been supported for a number of years and the last began in FY 2009.

- Operating and file systems for extreme scale computers with many thousands of multi-core processors with complicated interconnection networks.
- Performance and productivity tools for extreme scale systems that enable users to diagnose and monitor the performance of software and scientific application codes to enable users to improve performance and get scientific results faster.
- Programming models that enable today's computations and discover new models that scale to hundreds of thousands of processors to simplify application code development for petascale computing.
- Data management and visualization to transform extreme scale data into scientific insight through investments in visualization tools that scale to multi-petabyte datasets and innovative approaches to indexing and querying data.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

- Joint Applied Mathematics-Computer Science Institutes for the development of efficient new mathematical models, algorithms, libraries, and tools for next generation computers. Leading edge developers to directly address the new challenges from the next generation of computers and transfer this insight to key DOE application developers.

The Computer Science activity addresses two fundamental challenges. The first challenge is enabling science applications to harness computer systems with increasing scale and increasing complexity due to technology advances such as multicore chips. This challenge will require more dynamic behavior of system software (operating systems, file systems, compilers, performance tools) than historically developed. Substantial innovation is needed to provide essential system software functionality in a timeframe consistent with the anticipated availability of hardware. The second challenge is enabling scientists to effectively manage, analyze, and visualize the petabytes of data that result from extreme scale simulations and experimental facilities. Substantial innovation in computer science and applied mathematics is needed to provide essential system and application functionality in a timeframe consistent with the anticipated availability of hardware.

In FY 2011, the Computer Science activity will continue to focus on the challenges of emerging extreme scale architectures containing tens of thousands to millions of multicore and/or hybrid processors.

Computational Partnerships	**59,698**	**53,293**	**53,297**

The Computational Partnerships activity supports the Scientific Discovery through Advanced Computing (SciDAC) program to use results from applied mathematics and computer science research on scientific applications sponsored by other SC programs. These partnerships enable improved performance on high-end computing systems for scientists to conduct complex scientific and engineering computations at a level of detail that begins to resemble real-world conditions. The activities fall into four general categories:

- Nine multi-institutional *Centers for Enabling Technologies* represent almost half of the ASCR SciDAC activity. They are a focal point for bringing together a critical mass of leading experts from multiple disciplines to focus on key problems in a particular area such as performance, data management, optimization, or visualization. These SciDAC Centers address needs for new methods, algorithms and libraries; new methodologies for achieving portability and interoperability of complex scientific software packages; software tools and support for application performance; and more effective tools for feature identification, data management, and visualization.
- Four multi-institutional SciDAC Institutes are university-led centers of excellence which complement the efforts of the SciDAC Centers but with a role in the education and training of the next generation of computational scientists. These institutes reach out to a broader community of scientists to advance scientific discovery through advanced computation, collaboration, and training of graduate students and postdoctoral fellows.
- 35 multi-institutional *Science Applications Partnerships* are partnerships with other SC programs to dramatically improve the ability of their researchers to effectively utilize petascale computing to advance science. These partnerships support collaborative research between applied mathematicians and computer scientists (supported by ASCR) with domain scientists (supported by the other

programs) to refine and apply computational techniques and tools that address the specific problems of a particular research effort, such as modeling the reactive transport of contaminants through groundwater or developing an Earth System model that fully simulates the coupling between the physical, chemical, and biogeochemical processes in the global climate.

- With more than 80 participating institutions and hundreds of researchers developing tools, techniques, and software that push the state-of-the-art in high performance computing, the *SciDAC Outreach Center* ensures that SciDAC teams share information across projects and leverage taxpayer investment with other researchers. This small virtual organization, linked to user support at the ASCR facilities and organized by LBNL, provides a single resource to facilitate and accelerate the transfer of tools, techniques, and methods to the broader research community. The SciDAC Outreach Center is also a resource for INCITE applicants who need assistance in readying their application for leadership facilities.

In FY 2010, the Computational Partnerships activity began to support a small number of new interdisciplinary teams focused on transforming critical DOE applications for extreme scale computing. These competitively selected teams will evaluate the impact of directions in computer hardware on application capability, form a critical interface to existing SciDAC Centers and Institutes on the tool and library implications of these developments, and develop the understanding needed to enable these applications to execute effectively on future computer architectures.

In FY 2011, completion of several of the SciDAC projects initiated in FY 2006 will enable an expansion of these critical efforts. ASCR will also initiate new SciDAC partnerships with the Office of Electricity Delivery and Energy Reliability and/or the Office of Nuclear Energy.

	FY 2009	FY 2010	FY 2011
Next Generation Networking Research for Science	**14,732**	**14,321**	**14,321**

The Next Generation Networking Research for Science activity builds on results from Computer Science and Applied Mathematics to develop integrated software tools and advanced network services to enable large-scale scientific collaboration and to utilize the new capabilities of ESnet to advance DOE missions. The research falls into two general categories:

- Distributed systems software including scalable and secure tools and services to facilitate large-scale national and international scientific collaboration and high-performance software stacks to enable the discovery, management, and distribution of extremely large data sets generated by simulations or by science experiments such the Large Hadron Collider, the Intergovernmental Panel on Climate Change, and ITER.
- Advanced network technologies including dynamic optical network services, scalable cyber security technologies, and multi-domain, multi-architecture performance protocols to seamlessly interconnect and provide access to distributed computing resources and science facilities.

In FY 2011, research will continue to focus on developing the software, middleware and hardware that delivers 99.999% reliability up to and beyond one petabyte per second.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Small Business Innovative Research (SBIR)/ Small Business Technology Transfer (STTR)	**0**	**4,586**	**4,623**

In FY 2009, $3,612,000 and $432,000 were transferred to the SBIR and STTR programs respectively. The FY 2010 and FY 2011 amounts shown are the estimated requirements for continuation of the congressionally mandated SBIR and STTR programs.

	FY 2009	FY 2010	FY 2011
Total, Mathematical, Computational, and Computer Sciences Research	**150,373**	**163,792**	**165,091**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Applied Mathematics	
This increase will support the continued development of new and improved applied mathematical models, methods, and algorithms to understand complex systems.	+658
Computer Science	
This increase will support continued focus on the challenges of emerging extreme scale architectures containing tens of thousands to millions of multicore and/or hybrid processors.	+600
Computational Partnerships	
The increase, in addition to the completion of several awards initiated in FY 2006, will support additional efforts focused on getting critical applications ready to utilize extreme scale computing resources and new partnerships with DOE applied programs.	+4
SBIR/STTR	
SBIR/STTR increases as research funding is increased.	+37
Total Funding Change, Mathematical, Computational, and Computer Sciences Research	**+1,299**

High Performance Computing and Network Facilities
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
High Performance Computing and Network Facilities			
High Performance Production Computing	53,497	55,000	56,000
Leadership Computing Facilities	116,222	123,168	158,000
Research and Evaluation Prototypes	10,387	16,124	10,052
High Performance Network Facilities and Testbeds	28,293	29,722	30,000
SBIR/STTR	0	6,194	6,857
Total, High Performance Computing and Network Facilities	208,399	230,208	260,909

Description

The High Performance Computing and Network Facilities subprogram delivers forefront computational and networking capabilities to scientists nationwide. These include the High Performance Production Computing at the National Energy Research Scientific Computing Center (NERSC) facility at LBNL and Leadership Computing Facilities at Oak Ridge (OLCF) and Argonne (ALCF) National Laboratories. These computers, and the other SC research facilities, turn out many petabytes of data each year. Moving data to the researchers who need them requires advanced scientific networks and related technologies provided through High Performance Network Facilities and Testbeds. The subprogram also invests in long-term needs through the Research and Evaluation Prototypes activity.

Computing resources are allocated through competitive processes. Up to eighty percent of the processor time on the Leadership Computing Facilities is allocated through the Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program, which is open to all researchers and results in awards to a small number of projects, each requiring a substantial amount of the available resources. The high performance production computing facilities at NERSC are predominately allocated to researchers supported by SC programs. In FY 2011, all of the ASCR scientific computing facilities will also allocate ten to thirty percent of computing resources through the ASCR Leadership Computing Challenge program. This program is open year-round to scientists from the research community in academia and industry for special situations of interest to DOE with an emphasis on high-risk, high-payoff simulations in areas directly related to the DOE's energy mission, for national emergencies, or for broadening the community of researchers capable of using leadership computing resources.

FY 2009 Accomplishments

- *Oak Ridge Supercomputers Provide Understanding of the Conditions that Led to Past Abrupt Climate Changes.* Scientists at the University of Wisconsin and the National Center for Atmospheric Research (NCAR) used the OLCF to simulate abrupt climate change and shed new light on an enigmatic period of natural global warming in Earth's relatively recent history. The work was featured in the July 17, 2009 issue of the journal *Science* and provides valuable new data about the causes and effects of global climate change. The scientists used nearly a million processor hours in 2008 to run one-third of their simulation, from 21,000 years ago—the most recent glacial maximum—to 14,000 years ago—the planet's most recent major period of natural global warming.

With 4 million INCITE processor hours allocated on the OLCF for 2009-2011, they will complete the simulation, capturing climate from 14,000 years ago to the present and projecting it 200 years into the future. This research is funded by Biological and Environmental Research and the National Science Foundation through its paleoclimate program and support of NCAR.

- *Argonne Supercomputer Provides Breakthrough Computation of Thermal-Hydraulics in Nuclear Reactors.* The first simulation of the full physical configuration of 217 wire-wrapped fuel rods was run on the ALCF and achieved 80% parallel efficiency. The calculation of the pressure distribution of coolant flow exceeded 2.90 million spectral elements and used approximately 1 billion grid points. Over this three-year INCITE project many ASCR research innovations were utilized to improve scaling of the code without losing physical details. Experiments indicate that low pin count results do not extrapolate to higher pin counts because of the edge channel effects. These full scale results are allowing researchers to study coolant flow in a variety of core subassembly designs in order to optimize reactor performance.
- *National Energy Research Scientific Computing (NERSC) Helps Discover Cosmic Transients.* An innovative new sky survey, the Palomar Transient Factory, used the unique tools and services of NERSC to uncover more than 40 supernovae, or stellar explosions, during the commissioning phase and astronomers expect to be able to annually discover thousands more of these relatively rare and fleeting cosmic events. Such events occur about once a century in the Milky Way galaxy and are visible for only a few months.
- *Energy Sciences Network (ESnet) stimulates 100 Gbps technologies for DOE.* The ever growing demand for network bandwidth from large science collaborations, such as the Large Hadron Collider, requires ESnet to push toward next generation technologies to meet demand. However, the recession seemed to have stalled development of these technologies in early 2009. As a result, Secretary Chu announced in March that the Department of Energy would use Recovery Act funding to accelerate progress and deploy a prototype 100-gigabit per second data network. Across Europe and Asia, announcements of similar demonstrations quickly followed and industry began rolling out new offerings. ESnet is managing the Recovery Act-funded research project on advanced networking that is deploying a 100 Gbps test bed to develop the tools and techniques necessary to utilize this technology in the ESnet backbone beginning in FY 2010. Because of the strong connections between ESnet and this Recovery Act project, ESnet will be upgraded seamlessly to meet the growing, complex needs of DOE and remains on a path to deliver 1 terabit per second connectivity in 2014.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
High Performance Production Computing	**53,497**	**55,000**	**56,000**

This activity supports the NERSC facility located at LBNL. NERSC delivers high-end capacity computing services and supports the SC research community. Nearly 3,100 computational scientists in about 400 projects use NERSC to perform basic scientific research across a wide range of disciplines including astrophysics, chemistry, climate modeling, materials, high energy and nuclear physics, and biology. NERSC enables teams to prepare to use the ALCF and OLCF as well as to perform the calculations that are required by the missions of the SC programs. NERSC users are supported by SC programs with 60% based in universities, 29% in national laboratories, 6% in other government laboratories, and 3% in industry.

The costs for NERSC fall into three general areas: lease payments for high performance computing hardware, operations (space, power, cooling, maintenance, tapes, etc.), and operating and support staff.

NERSC's large user base requires an extremely agile support staff. Careful planning of upgrades is critical to meeting increasing demand within a stable funding profile.

FY 2011 funding will support operation of the NERSC high-end capability systems (NERSC-5 and NERSC-6), lease payments, and user support. With the acquisition and operation of NERSC-6, the total capacity of NERSC in FY 2011 will be approximately one petaflop. The NERSC computational resources are integrated by a common high performance file storage system that enables users to easily migrate to any of the available resources. With approximately 60 petabytes of storage and an average transfer rate in the hundreds of megabytes per second, this system also allows users to easily move data into and out of the NERSC facility.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	8,585	N/A	N/A
Planned Operating Hours	8,585	8,585	8,585
Optimal Hours	8,585	8,585	8,585
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	3,100	3,100	3,100

	FY 2009	FY 2010	FY 2011
Leadership Computing Facilities	**116,222**	**123,168**	**158,000**

The Leadership Computing Facilities activity enables open scientific applications to harness the potential of leadership computing to advance science. 2009 saw the realization of that vision, with the top system in the independent international "Top 500" ranking of supercomputers and a second Gordon Bell prize for a petascale science application that provided new insights into magnetic materials. This new era of petaflop science opens significant opportunities to dramatically advance research as simulations more realistically capture the behavior of, for example, materials and ITER scale fusion devices. The success of this effort is built on the gains made in research and evaluation prototypes, the SciDAC program, and research in applied mathematics and computer science.

The costs for both the ALCF and OLCF fall into three general areas: lease payments, operations (space, power, cooling, maintenance, tapes, etc.), and operating and support staff. In FY 2011, costs are driven by increases in lease payments at both facilities in accordance with the approved baselines.

	FY 2009	FY 2010	FY 2011
▪ **Leadership Computing Facility at ORNL (OLCF)**	**87,680**	**81,168**	**96,000**

In FY 2009, with Recovery Act funds, the OLCF's Cray XT5 system was upgraded to 2.33 petaflops—making it the most powerful computer in the world. In addition, the facility also continues to operate a 263 teraflop Cray XT4 machine for INCITE projects, ASCR Leadership Computing Challenge projects, scaling tests, and tool and library developers. The facility staff is

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

continuing to focus on assisting users to fully utilize the OLCF resources. As a result, several applications, such as combustion studies in diesel jet flame stabilization, simulations of neutron transport in fast reactor cores, and groundwater flow in porous media, are running at petascale.

In FY 2011, the request supports an increase in lease payments for the XT5 and the acquisition of an experimental prototype with a hybrid architecture—a mix of standard processors and specialized processing engines (such as a Global Processing Unit [GPU], a field-programmable gate array [FPGA], or a vector processor) that offer greater efficiency and computing power but also introduce new system and application programming challenges. The OLCF activity will also support operation and INCITE allocation of the two Cray systems and will continue to provide support to INCITE projects, pioneer applications, and tool and library developers.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	7,008	N/A	N/A
Planned Operating Hours	7,008	7,008	7,008
Optimal Hours	7,008	7,008	7,008
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	496	550	625

- **Leadership Computing Facility at ANL (ALCF)** **28,542** **42,000** **62,000**

The ALCF provides a high performance IBM Blue Gene/P with low-electrical power requirements and a peak capability of 556 teraflops. This facility provides diversity in the DOE leadership resources and supports many applications, including molecular dynamics and materials. This system is better suited to these computing needs than the OLCF and NERSC. The ALCF staff operate and maintain the computing resources and provide support to INCITE projects, ASCR Leadership Computing Challenge projects, scaling tests, and tool and library developers.

In FY 2011, the request supports increases in the lease payments on the Blue Gene/P in accordance with the approved schedule. In addition, ALCF will support site preparations for acquisition of a next generation machine. This machine is expected to be approximately 10-20 petaflops, such as the system being developed through the joint research project with NNSA and IBM on the Blue Gene/Q. The ALCF activity will also support operation and INCITE allocation of the Blue Gene/P in FY 2011 and will continue to provide support to INCITE projects, pioneer applications, and tool and library developers.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	7,008	N/A	N/A
Planned Operating Hours	7,008	7,008	7,008
Optimal Hours	7,008	7,008	7,008
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	100	200	300

	FY 2009	FY 2010	FY 2011
Research and Evaluation Prototypes	**10,387**	**16,124**	**10,052**

The Research and Evaluation Prototypes activity addresses the challenges of next generation computing systems. As computer chips approach critical physical limits, we begin an era of radical innovation. These systems will likely be significantly more complex than current computing systems. As a result, many of the tools and techniques developed over the past decade will no longer be effective. By actively participating in the development of these next-generation machines, ASCR can ensure that the most appropriate architectures for science are developed while researchers will better understand their inherent challenges and can begin to work on overcoming those challenges. The Research and Evaluation Prototype activity will prepare researchers to effectively utilize the next generation of scientific computers and will also reduce the risk of future major procurements.

In FY 2011, the Research and Evaluation Prototypes activity will complete SC's partnership with the NNSA and the Defense Advanced Research Projects Agency (DARPA) program for High Productivity Computing Systems. ASCR will continue to work cooperatively with the NNSA on new, smaller scale prototype projects to explore architectures on the path toward exascale computing (capable of an exaflop, or 10^{18} floating point operations per second). These prototype projects will be tightly coupled with research in advanced computer architectures supported by the Computer Science activity.

	FY 2009	FY 2010	FY 2011
High Performance Network Facilities and Testbeds	**28,293**	**29,722**	**30,000**

This activity supports operation and upgrades for the Energy Science network (ESnet), which provides a high bandwidth network connecting DOE researchers with large-scale scientific user facilities and other scientific instruments. Each year the amount of data generated by these facilities roughly doubles. To meet demand, ESnet has partnered with Internet2—the leading provider of university networks—to push the state-of-the-art and deliver next generation optical network technologies that greatly expand capacity in the core science networks. Continued progress in high performance networks builds on the tools and knowledge developed by the Next Generation Networks for Science research activity and by innovations developed in partnership with Internet2.

The costs for ESnet are dominated by operations which includes refreshing hardware, such as switches and routers, on an accelerated schedule to ensure the 99.999% reliability that is required for large scale scientific data transmission.

In FY 2009, a Recovery Act supported research effort implemented a national testbed of next generation optical technologies that allow networks, such as ESnet, to gain a ten-fold increase in

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

bandwidth on existing fiber. The testbed allows ASCR to develop and harden the tools necessary to ensure data integrity and network reliability with this new technology. In FY 2011, ASCR will begin to deploy this next generation technology to enable 100 Gbps per wavelength. As a result of research supported by the Recovery Act, ESnet is on a path to achieving 1,000 Gbps connectivity.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	8,760	N/A	N/A
Planned Operating Hours	8,760	8,760	8,760
Optimal Hours	8,760	8,760	8,760
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0.01%	0.01%	0.01%
Number of Users[a]	N/A	N/A	N/A

	FY 2009	FY 2010	FY 2011
Small Business Innovative Research (SBIR)/ Small Business Technology Transfer (STTR)	**0**	**6,194**	**6,857**

In FY 2009, $5,360,000 and $644,000 were transferred to the SBIR and STTR programs respectively. The FY 2010 and FY 2011 amounts shown are the estimated requirements for continuation of the congressionally mandated SBIR and STTR programs.

	FY 2009	FY 2010	FY 2011
Total, High Performance Computing and Network Facilities	**208,399**	**230,208**	**260,909**

Explanation of Funding Changes

	FY 2010 vs. FY 2009 ($000)
High Performance Production Computing	
The increase will support operation of the NERSC high-end capability systems (NERSC-5 and NERSC-6), lease payments, and user support.	+1,000
Leadership Computing Facilities (LCFs)	
The increase covers increases in lease payments at both facilities in accordance with approved schedule. The OLCF will acquire a prototype machine with a hybrid architecture. At the ALCF, the increase supports site preparation for acquisition of a next generation machine.	+34,832

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[a] The ESnet is a high performance scientific network that connects DOE facilities to researches around the world and it is therefore not possible to estimate users.

	FY 2010 vs. FY 2009 ($000)
Research and Evaluation Prototypes	
The decrease is due to final payment for the DARPA High Productivity Computing Systems project. Support is increased for new, smaller scale prototype projects to explore architecture features on the path toward exascale computing.	-6,072
High Performance Network Facilities and Testbeds	
The increase will enable ESnet to begin to deliver 100 Gbps connections in FY 2011. The increase in bandwidth is critical to meeting the growing requirements for DOE applications and facilities.	+278
SBIR/STTR	
Increase in SBIR/STTR due to increase in operating expenses.	+663
Total Funding Change, High Performance Computing and Network Facilities	**+30,701**

Supporting Information

Operating Expenses, Capital Equipment, and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	348,595	385,000	410,000
Capital Equipment	10,177	9,000	16,000
Total, Advanced Scientific Computing Research	358,772	394,000	426,000

Funding Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	160,760	186,110	182,000
Scientific User Facility Operations	198,012	207,890	244,000
Total, Advanced Scientific Computing Research	358,772	394,000	426,000

Scientific User Facility Operations

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
NERSC	53,497	55,000	56,000
OLCF	87,680	81,168	96,000
ALCF	28,542	42,000	62,000
ESnet	28,293	29,722	30,000
Total, Scientific User Facility Operations	198,012	207,890	244,000

Facilities Users and Hours

	FY 2009	FY 2010	FY 2011
NERSC			
Achieved Operating Hours	8,585	N/A	N/A
Planned Operating Hours	8,585	8,585	8,585
Optimal Hours	8,585	8,585	8,585
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	3,100	3,100	3,100

	FY 2009	FY 2010	FY 2011
ESnet			
Achieved Operating Hours	8,760	N/A	N/A
Planned Operating Hours	8,760	8,760	8,760
Optimal Hours	8,760	8,760	8,760
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0.01%	0.01%	0.01%
Number of Users	N/A	N/A	N/A
OLCF			
Achieved Operating Hours	7,008	N/A	N/A
Planned Operating Hours	7,008	7,008	7,008
Optimal Hours	7,008	7,008	7,008
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	496	550	625
ALCF			
Achieved Operating Hours	7,008	N/A	N/A
Planned Operating Hours	7,008	7,008	7,008
Optimal Hours	7,008	7,008	7,008
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	100	200	300
Total			
Achieved Operating Hours	31,361	N/A	N/A
Planned Operating Hours	31,361	31,361	31,361
Optimal Hours	31,361	31,361	31,361
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	1%	1%	1%
Number of Users	3,696	3,850	4,025

Scientific Employment

	FY 2009 Estimated	FY 2010 Estimated	FY 2011 Estimated
# University Grants	205	210	210
Average Size	$194,000	$224,000	$232,000
# Laboratory Projects	175	180	185
# Graduate Students (FTEs)	533	563	582
# Permanent Ph.D.s (FTEs)	735	766	791
# Other (FTEs)	248	246	281

Basic Energy Sciences

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Basic Energy Sciences				
Materials Sciences and Engineering	1,108,351[b]	+221,788	363,642	432,663
Chemical Sciences, Geosciences, and Energy Biosciences	281,946	+169,072	296,934	403,616
Scientific User Facilities	0[b]	0	821,684	847,121
Subtotal, Basic Energy Sciences	1,390,297	+390,860	1,482,260	1,683,400
Construction	145,468	+164,546	154,240	151,600
Total, Basic Energy Sciences	1,535,765[c]	+555,406	1,636,500	1,835,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 108–153, "21st Century Nanotechnology Research and Development Act 2003"
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The mission of the BES program is to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security.

Background

Our ability to discover and transform the material resources that nature provides has shaped history and built civilizations. From prehistoric hunters and gatherers, who utilized wood-burning fires and fashioned tools from stone, to modern nations that run on processes powered primarily by coal and oil, progress has been marked by advanced technologies designed to make better use of Earth's resources. Today, science and technology is even more at the heart of many critical societal, political, and economic issues that surround the energy security and sustainability of our nation.

Fundamentally, the energy challenges of the next century will increasingly involve scientific discovery and technological innovation. The lessons of the previous century illustrate that major breakthroughs in energy technologies are largely built on a solid foundation of research advances. At the core of these advances is the ability to create new materials using sophisticated synthetic and processing techniques, precisely define the atomic arrangements in matter, and control physical and chemical transformations.

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] FY 2009 funding of $771,198,000 for Scientific User Facilities is located within the Materials Sciences and Engineering subprogram. The Materials Sciences and Engineering subprogram FY 2009 total, excluding Scientific User Facilities funding is $337,153,000.

[c] Total is reduced by $36,207,000; $32,328,000 of which was transferred to the Small Business Innovation Research (SBIR) program and $3,879,000 of which was transferred to the Small Business Technology Transfer (STTR) program.

The research disciplines that the BES program supports—condensed matter and materials physics, chemistry, geosciences, and aspects of physical biosciences—are those that discover new materials and design new chemical processes. These disciplines touch virtually every aspect of energy resources, production, conversion, transmission, storage, efficiency, and waste mitigation. BES research provides a knowledge base to help understand, predict, and ultimately control the natural world and serves as an agent of change in achieving the vision of a secure and sustainable energy future.

The BES program is one of the nation's largest sponsors of research in the natural sciences. In FY 2009, the program funded research in more than 170 academic institutions located in 50 states and in 14 DOE laboratories located in 12 states. BES supports a large extramural research program, with approximately 40% of the program's research activities sited at academic institutions. The BES program also supports world-class scientific user facilities that provide outstanding capabilities for imaging; for characterizing materials of all kinds from metals, alloys, and ceramics to fragile biological samples; and for studying the chemical transformation of materials. These facilities are used to correlate the microscopic structure of materials with their macroscopic properties, which provides critical insights to their electronic, atomic, and molecular configurations, often at ultrasmall length and ultrafast time scales.

The energy systems of the future, whether they tap sunlight, store electricity, or make fuel from splitting water or reducing carbon dioxide, will revolve around materials and chemical changes that convert energy from one form to another. Such materials will need to be more functional than today's energy materials. To control chemical reactions or to convert a solar photon to an electron requires coordination of multiple steps, each carried out by customized materials with designed nanoscale structures. Such advanced materials are not found in nature; they must be designed and fabricated to exacting standards using principles revealed by basic science.

The 20th century witnessed revolutionary advances in physical sciences, bringing remarkable discoveries such as high temperature superconductors, electron microscopy with atomic resolution, and carbon nanotubes that combine the strength of steel with the mass of a feather. Observational science is now giving birth to the science of control, where accumulated knowledge derived from observations is used to design, initiate, and direct the chemical and physical behavior of materials at atomic and nanoscale. BES-supported research stands at the dawn of an age in which materials can be built with atom-by-atom precision and computational models can predict the behavior of materials before they exist. These capabilities, unthinkable only a few decades ago, create unprecedented opportunities to revolutionize the future of sustainable energy applications and beyond, from information management to national security.

Subprograms

To accomplish its mission and address the scientific challenges outlined above, the BES program is organized into three subprograms: Materials Sciences and Engineering; Chemical Sciences, Geosciences, and Energy Biosciences; and Scientific User Facilities.

The *Materials Sciences and Engineering* subprogram supports research that explores the origin of macroscopic material behaviors and their fundamental connections to atomic, molecular, and electronic structures. At the core of the subprogram is the quest for a paradigm shift for the deterministic design and discovery of new materials with novel structures, functions, and properties. To accomplish this goal, the portfolio stresses the need to probe, understand, and control the interactions of phonons, photons, electrons, and ions with matter to direct and control energy flow in materials systems over multiple time and length scales. Such understanding and control are critical to science-guided design of highly efficient energy conversion processes, such as new electromagnetic pathways for enhanced light emission in solid-state lighting and multi-functional nanoporous structures for optimum charge transport in batteries and fuel cells. This subprogram also seeks to conceptualize, calculate, and predict processes underlying physical transformations, tackling challenging real-world systems—for example, materials with many atomic constituents, with complex architectures, or that contain defects; systems that exhibit correlated emergent behavior; and systems that are far from equilibrium. Such understanding will be critical to developing predictive capability for complex systems behavior, such as in superconductivity and magnetism. The subprogram also supports the development and advancement of the experimental and computational tools and techniques that in turn enable the understanding of the behaviors of materials, especially their reactivity under the full range of extreme conditions and the ability to predict the structure and properties of formed phases. Finally, the subprogram exploits the interfaces between physical and biological sciences to explore bio-mimetic processes as new approaches to novel materials design. This subprogram will also support an Energy Innovation Hub focused on Batteries and Energy Storage.

The *Chemical Sciences, Geosciences, and Energy Biosciences* subprogram supports research that explores fundamental aspects of chemical reactivity and energy transduction over an enormous range of scale and complexity. Phenomena are studied over spatial scales from the sub-nanometer, as defined by the structure of atoms and molecules, to kilometers, appropriate to the behavior of subsurface geological structures, and over time scales defined by the motions of electrons in atoms, attoseconds (10^{-18} seconds), to millennia over which geological change must be understood. At the heart of this research lies the quest to understand and control chemical reactions and the transformation of energy at the molecular scale in systems ranging from simple atoms and molecules, to active catalysts, to complex biochemical or geochemical moieties. At the most fundamental level, the development and understanding of the quantum mechanical behavior of electrons, atoms, and molecules in the 20th century has now evolved into the ability to control and direct such behavior to achieve desired results, such as the optimal conversion of solar energy into electronic excitation in molecular chromophores or into the creation of multiple charge carriers in nanoscale semiconductors. This subprogram also seeks to extend this era of 21st century control science to include the capability to tailor chemical transformations with atomic and molecular precision. Here, the goal is fully predictive capability for larger, more complex chemical systems, such as interfacial catalysis, at the same level of detail now known for simple molecular systems. Finally, this subprogram seeks ultimately to extend a molecular level understanding and control to the emergent and highly non-equilibrium behavior of biological and geological systems through the application of modern experimental and computational tools. This subprogram will also support an Energy Innovation Hub focused on Fuels from Sunlight.

The *Scientific User Facilities* subprogram supports the operation of a nationwide suite of major facilities that provide open access to sophisticated instrumentation needed to probe and create materials for scientists of many disciplines from academia, national laboratories, and industry. These large-scale user facilities consist of a complementary set of intense x-ray sources, neutron scattering centers, electron beam characterization capabilities, and research centers for nanoscale science. These facilities probe materials in space, time, and energy with the appropriate resolutions that can interrogate the inner workings of matter—transport, reactivity, fields, excitations, and motion—to answer some of the most challenging grand science questions. Taking advantage of the intrinsic charge, mass, and magnetic characteristics of x-rays, neutrons, and electrons, these tools offer unique capabilities to help understand the fundamental aspects of the natural world. The subprogram recognizes that at the heart of scientific discovery lies advanced tools and instruments. The continual development and renovation of the instrumental capabilities includes new x-ray and neutron experimental stations, improved core facilities, and new stand-alone instruments. The subprogram also manages a research portfolio in accelerator and detector development to explore technology options for developing the next generations of x-ray and neutron sources. Collectively, these user facilities and enabling tools produce a host of important research results that span the continuum from basic to applied research and embrace the full range of scientific and technological endeavors, including chemistry, physics, geology, materials science, environmental science, biology, and biomedical science. These capabilities offer critical scientific insights for the discovery and design of advanced materials and novel chemical processes with broad societal impacts, from energy applications to information and biomedical technologies.

Benefits

The BES program supports basic research that underpins a broad range of energy technologies. Research in materials sciences and engineering leads to the development of materials that improve the efficiency, economy, environmental acceptability, and safety of energy generation, conversion, transmission, storage, and use. For example, advances in superconductivity have been introduced commercially in a number of demonstration projects around the country. Improvements in alloy design for high temperature applications are used in commercial furnaces and in green technologies such as lead-free solder. Research in chemistry has led to advances such as efficient combustion systems with reduced emissions of pollutants; new solar photoconversion processes; improved catalysts for the production of fuels and chemicals; and better separations and analytical methods for applications in energy processes, environmental remediation, and waste management. Research in geosciences results in advanced monitoring and measurement techniques for reservoir definition and an understanding of the fluid dynamics of complex fluids through porous and fractured subsurface rock. Research in the molecular and biochemical nature of photosynthesis aids the development of solar photo-energy conversion.

The BES program also plays a major role in enabling the nanoscale revolution. The importance of nanoscience to future energy technologies is clearly reflected by the fact that all of the elementary steps of energy conversion (e.g., charge transfer, molecular rearrangement, and chemical reactions) take place on the nanoscale. The development of new nanoscale materials, as well as the methods to characterize, manipulate, and assemble them, create an entirely new paradigm for developing new and revolutionary energy technologies.

Program Planning and Management

Inputs to program planning and prioritization include overall scientific opportunity, projected investment opportunity, DOE mission need, and Administration and Departmental priorities. Many long-range planning exercises for elements of the BES program are performed under the auspices of the Basic Energy Sciences Advisory Committee (BESAC). During the past few years, BESAC has provided advice on new directions in nanoscale science and complex systems; on the operation of the major scientific user facilities; on the need for new, next-generation facilities for x-ray, neutron, and electron-beam scattering; on performance measurement; on the quality of the BES program management and its consequent impacts on the program portfolio; on new directions in research relating to specific aspects of fundamental science such as catalysis, biomolecular materials, and computational modeling at the nanoscale; on the fundamental research challenges posed by the Department's energy missions; on a 20-year roadmap for BES facilities; and on theory and computation needs across the entire portfolio of BES research.

Of particular note is the 2003 BESAC report, *Basic Research Needs to Assure a Secure Energy Future*, which was the foundation for ten follow-on Basic Research Needs workshops supported by BES in the past six years in the areas of the hydrogen economy, solar energy utilization, superconductivity, solid-state lighting, advanced nuclear energy systems, combustion of 21st century transportation fuels, electrical-energy storage, geosciences as it relates to the storage of energy wastes (the long-term storage of both nuclear waste and carbon dioxide), materials under extreme environments, and catalysis for energy applications. Together these workshops attracted over 1,500 participants from universities, industry, and DOE laboratories. BESAC was charged with summarizing the results of these ten workshops and relating this summary to the science themes identified in the 2007 BESAC Grand Challenges study. A report, entitled *New Science for a Secure and Sustainable Energy Future*, was released in December 2008. The report highlighted the magnitude of the challenges in the realm of energy and environment facing the U.S and the importance of fundamental science to finding transformational solutions.

Together these reports describe a continuum of research spanning the most fundamental questions of how nature works to the questions that address technological show-stoppers in the applied research programs supported by the DOE technology offices. Dealing with these issues requires breakthrough advances with new understanding, new materials, and new phenomena that will come from fundamental science. The BES program portfolios have been reassessed and restructured to reflect the results of these workshops.

Planning for the facilities of the BES program is also an ongoing activity. The BES program has a long tradition of planning, constructing, and operating facilities well. During the past ten years, the BES program has delivered nearly $2 billion of facilities and upgrades on schedule and within budget. Among others, this includes the Spallation Neutron Source, the complete reconstruction of the Stanford Synchrotron Radiation Light Source, five Nanoscale Science Research Centers, the Linac Coherent Light Source, and numerous instrument fabrication projects. Recently, BESAC sponsored a workshop *Next-Generation Photon Sources for Grand Challenges in Science and Energy* to explore the scientific frontiers that could be tackled with next generation photon sources. The workshop identified new research opportunities in materials, chemistry, biology, medicine, environment, and physics for science and energy that can be addressed with diffraction, excitation, and imaging by photons. BES will build on this foundation with a workshop to assess the technical readiness of various accelerator-based techniques for 4th generation light sources and the corresponding R&D needs. It is expected that the output of these workshops will help set the course for photon science facilities for the next decade.

All research projects supported by BES undergo regular peer review and merit evaluation based on procedures set down in 10 CFR Part 605 for the extramural grant program and in an analogous process for the laboratory programs and scientific user facilities. The BES peer review process evaluates the following four criteria, in order of decreasing importance: scientific and/or technical merit of the project, appropriateness of the proposed method or approach, competency of the personnel and adequacy of proposed resources, and reasonableness and appropriateness of the proposed budget. The criteria for review may also include other appropriate factors established and announced by BES.

Facilities are reviewed using external, independent review committees operating according to the procedures established for peer review of BES laboratory programs and facilities. Important aspects of the reviews include assessments of the quality of research performed at the facility, the reliability and availability of the facility, user access policies and procedures, user satisfaction, facility staffing levels, R&D activities to advance the facility, management of the facility, and long-range goals of the facility. The outcomes of these reviews helped improve operations and develop new models of operation for existing light sources, the Spallation Neutron Source, and the National Synchrotron Light Source-II (NSLS-II), which began construction in FY 2009.

Facilities that are in design or construction are reviewed according to procedures set down in DOE Order 413.3A "Program and Project Management for Capital Assets" and in the Office of Science "Independent Review Handbook."[a] In general, once a project has entered the construction phase, it is reviewed with external, independent committees approximately biannually. These Office of Science construction project reviews enlist experts in the technical scope of the facility under construction and its costing, scheduling, and construction management.

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[a] http://www.science.doe.gov/opa/PDF/revhndbk.pdf

Information and reports for all of the above mentioned advisory and consultative activities are available on the BES website.[a] Other studies are commissioned as needed using the National Academies' National Research Council and other independent groups.

Basic and Applied R&D Coordination

As is demonstrated by the depth and scope of the Basic Research Needs workshop series, the BES program is committed to R&D integration. These workshops and the follow-on solicitations seek to partner the BES program with its counterparts in the DOE technology offices and NNSA. Many activities facilitate cooperation and coordination between BES and the applied research programs, including joint efforts in strategic planning, solicitation development, peer reviews, and program contractors meetings. For example, in hydrogen research, BES has actively engaged with the Offices of Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy to coordinate activities such as budget submissions, solicitation topic selections and proposal reviews, posture plan development, and joint contractors meetings. BES also participates in interagency coordination activities, such as the Interagency Working Group on Hydrogen and Fuel Cells led by the White House Office of Science and Technology Policy; the Hydrogen Technical Advisory Committee (HTAC), a Federal Advisory Committee established by the Energy Policy Act of 2005 to advise the Secretary of Energy on issues related to hydrogen and fuel cell research, development, demonstration, and deployment; and the Hydrogen and Fuel Cell Interagency Task Force consisting of senior agency representatives across the federal government. BES also coordinates with the Office of Energy Efficiency and Renewable Energy and the Office of Electricity Delivery and Energy Reliability on electrical energy storage research for transportation and grid-level storage, respectively. BES has involved program managers in both offices in regular information exchange meetings and in developing a preliminary coordination plan in electrical energy storage. Since FY 2007, BES has worked with the Office of Electricity Delivery and Energy Reliability to initiate SBIR awards in electrical energy storage for grid applications.

At the program manager level, there have been regular intra-departmental meetings for information exchange and coordination on solicitations, program reviews and project selections in research areas such as biofuels derived from biomass; solar energy utilization; hydrogen production, storage, and use; building technologies, including solid-state lighting; advanced nuclear energy systems and advanced fuel cycle technologies; vehicle technologies; improving efficiencies in industrial processes; and superconductivity for grid applications. These activities facilitate cooperation and coordination between BES and the technology offices and defense programs. DOE program managers have also established formal technical coordinating committees (e.g., the Energy Materials Coordinating Committee) that meet on a regular basis to discuss R&D programs with wide applications for basic and applied programs. Additionally, technology offices staff participate in reviews of BES research, and BES staff participate in reviews of research funded by the technology offices.

The Department's national laboratory system plays an important role in the ability of BES to effectively integrate research and development by providing opportunities to collocate activities at the laboratories. Co-funding and co-siting of research by BES and DOE technology programs at the same institutions, such as the DOE laboratories or universities, has proven to be a valuable approach to facilitate close integration of basic and applied research. In these cases, teams of researchers benefit by sharing of resources, expertise, and knowledge of research breakthroughs and program needs.

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[a] http://www.sc.doe.gov/bes/

Budget Overview

The FY 2011 budget request provides targeted increases and sets new directions in two key components in the BES program: research that advances understanding of the natural world and addresses the DOE mission and enabling tools—the operation and construction of scientific user facilities and the development of unique instruments for the nation. A significant portion of the funding increase will be devoted to expand the research program to capture new, emerging opportunities by furthering its scientific reach and potential technological impact.

BES supports three types of research rewards—core research, Energy Frontier Research Centers (EFRCs), and Energy Innovation Hubs. These funding mechanisms constitute an increasing progression of scientific scope and level of effort. The BES core research awards permit individual scientists and small groups to pursue their discovery-driven research interests with broad energy relevance. The dozens of EFRC awards bring together multiple investigators to address major scientific challenges necessary to solve complex energy research problems. The Hub awards focus multiple teams of researchers—each working in separate but collaborative research areas—on overcoming the related scientific barriers to development of a complete energy system that has potential for implementation into a transformative energy technology. The core research represents over 70% of the total BES research funding and complements larger group efforts comprised of the EFRCs and the Energy Innovation Hubs.

- *BES core research*—primarily supporting single principal investigator and small group projects—will be continued and expanded to initiate promising new activities in research areas in response to the five grand challenges identified in the BESAC Grand Challenges report: quantum control of electrons in atoms, molecules, and materials, with an emphasis on molecular science and engineering; basic architecture of matter; directed assemblies, structure, and properties; emergence of collective phenomena; energy and information on the nanoscale; and matter far beyond equilibrium. An increase in funding for ultrafast science, which deals with phenomena that occur in the range of one-trillionth of a second (one picosecond) to less than one-quadrillionth of a second (one femtosecond), is requested in FY 2011. This research has the promise of expanding our understanding of chemistry and materials sciences by allowing real-time stroboscopic investigations of the earliest stages of dynamic phenomena. Such knowledge will be critical to advancing the science frontiers in energy transduction in natural and artificial solar energy conversion systems, real-time bond breakage and formation in catalytic reactions, the dynamics of materials in extreme environments, correlation in strongly correlated electron systems, the nucleation of defects in materials that result in the degradation of their properties, and structural dynamics in complex biomolecules. Additional research will also be initiated in the area of multiscale modeling for advanced engine design.

  In FY 2011, approximately $24 million will be available to fund core research efforts in two additional categories: discovery and development of new materials that are critical to both science frontiers and technology innovations, and basic research for energy needs in a limited number of areas as shown below.

  - *Discovery and development of new materials.* Research in this category will focus on new synthesis capabilities, including bio-inspired approaches, to establish a strong foundation for science-driven materials discovery and synthesis in the U.S. This work will focus on materials broadly and will include crystalline materials, which have been highlighted recently as an essential component of the science grand challenges in the 2007 BESAC report Directing Matter and Energy: Five Challenges for Science and the Imagination. As described in the November 2009 NRC report Frontiers in Crystalline Matter: From Discovery to Technology, the U.S., once the world leader in the discovery and growth of crystalline materials, has fallen behind other nations. Single crystals are vital in understanding the characteristics and properties of new materials, and they also have applications in devices that involve semiconductors, lasers, precision timing devices, solar cells or high temperature operations and provide a natural platform to explore novel states of matter.

  - *Basic research for energy needs.* Major areas of emphasis will be in fundamental sciences related to carbon capture and advanced nuclear energy systems. For carbon capture, focused areas include the rational design of novel materials and separation processes for post-combustion CO_2 capture, as well as catalysis and separation research for novel carbon capture schemes to aid the design of future power plants. For advanced nuclear energy systems, focused areas include radiation resistant materials in fission and fusion applications and separation science and heavy element chemistry for fuel cycles.

- *Energy Frontier Research Centers (EFRCs),* established in FY 2009, are multi-investigator and multi-disciplinary centers to engage the talents of the nation's researchers for the broad energy sciences. The EFRCs harness the most basic and advanced discovery research in a concerted effort to accelerate the scientific breakthroughs needed to create advanced energy technologies for the 21st century. These centers bring together critical masses of researchers to conduct fundamental energy research in a new era of grand challenge science and use-inspired energy research. The scientific directions of the EFRCs are overseen by program staff in the Materials Sciences and Engineering subprogram and the Chemical Sciences, Geosciences, and Biosciences subprogram, who are managed centrally within BES to ensure a unified management strategy and structure. In FY 2011, approximately $40 million will be available to fund additional EFRCs. New EFRCs will be competitively solicited in the two categories described above under core reserach: discovery and development of new materials that are critical to both science frontiers and technology innovations, and basic research for energy needs in a limited number of areas that are underrepresented in the 46 original EFRC awards.

- *Energy Innovation Hubs* were initiated by the Department in FY 2010. The Hubs aim to assemble multidisciplinary teams to address basic science and technology hindering the nation's secure and sustainable energy future. Because the components and processes of energy systems are highly interdependent, innovative solutions to real-world energy challenges will require concerted efforts that couple the various elements of the technology chain and combine the talents of universities, national laboratories, and the private sector. The Energy Innovation Hubs comprise a larger set of investigators spanning science, engineering, and other disciplines, but focused on a single critical national need identified by the Department. Top talent drawn from the full spectrum of R&D performers—universities, private industry, non-profits, and government laboratories—drive each Hub to become a world leading R&D center in its topical area. With robust links to industry, the highly integrated Hubs can bridge the gap between basic scientific breakthroughs and industrial commercialization. In FY 2011, BES will support the continuation of the Fuels from Sunlight Hub and will initiate a new Hub on Batteries and Energy Storage.

The FY 2011 budget request provides continued support for the operations of the suite of BES scientific user facilities, including four x-ray synchrotron sources, three neutron sources, and five nanoscale science research centers. The total request represents an average of 3.5% increase over the FY 2010 funding level and provides near optimal support for the user operations. Funding is also provided for instrumentation to upgrade BES beamlines at the light source facilities. The Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory provides laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak power and peak brightness than any existing coherent x-ray light source, with pulse lengths of femtoseconds—the timescale of atomic motion. The LCLS will begin the first full year of operations in FY 2011. These facilities provide key capabilities for the fabrication of novel materials, for the examination of materials and their transformations at the atomic scale, and to enable scientists to correlate microscopic structures to macroscopic properties.

Recognizing that at the heart of discovery often lies with the development of new tools and instruments; BES continues to support the planning, R&D, and construction of new scientific user facilities and the associated enabling tools. The new generations of instruments will naturally bring forth devices to direct matter at the levels of electrons, atoms, or molecules, as highlighted in the BESAC Grand Challenges report.

The construction of the National Synchrotron Light Source II (NSLS-II) will continue at Brookhaven National Laboratory, including the largest component of the project—the building that will house the accelerator ring. The Spallation Neutron Source Instruments-Next Generation (SING-I, funding to be completed in FY 2011, and SING-II) and the Power Upgrade Project (PUP), as part of the planned upgrades to the Spallation Neutron Source at Oak Ridge National Laboratory, will be supported according to planned schedules and funding profiles.

Annual Performance Results and Targets

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering

GPRA Unit Program Goal: Basic Energy Sciences Program Goal: Advance the Basic Science for Energy Independence – Provide the scientific knowledge and tools to achieve energy independence, securing U.S. leadership and essential breakthroughs in basic energy sciences.

Annual Performance Measure: Annual Performance Measure: Temporal resolution; maintain x-ray pulse of less than 100 femtoseconds in duration and containing more than 100 million (108) photons per pulse.[a]

FY 2006	T: Demonstrate an X-ray pulse of less than 100 femtoseconds in duration and containing more than 100 million photons per pulse. A: Goal met
FY 2007	T: Demonstrate an X-ray pulse of less than 100 femtoseconds in duration and containing more than 100 million photons per pulse. A: Goal met
FY 2008	T: Maintain x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million (10^8) photons per pulse. A: Goal met
FY 2009	T: Maintain x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million (10^8) photons per pulse. A: Goal met

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[a] No further improvement is expected beyond 2008 for these measures since the current suite of instruments has met their maximum performance level. This target is a measure of SC's intent to maintain the maximum level of performance for users of the current SC facilities until the next generation of instruments and facilities becomes available.

FY 2010– FY 2015	T: Maintain x-ray pulses that are <100 femtoseconds in duration and have an intensity of >100 million (10^8) photons per pulse. A: TBD

Annual Performance Measure: Spatial Resolution; maintain spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm.[a]

FY 2006	T: Demonstrate spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm. A: Goal met
FY 2007	T: Demonstrate spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm. A: Goal met
FY 2008	T: Maintain spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm. A: Goal met
FY 2009	T: Maintain spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm. A: Goal met
FY 2010– FY 2015	T: Maintain spatial resolutions for imaging in the hard x-ray region of <100 nm and in the soft x-ray region of <18 nm, and spatial information limit for an electron microscope of 0.08 nm. A: TBD

Annual Performance Measure: Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects.

FY 2006	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2007	T: Cost and schedule variance are both less than 10% A: Goal not met

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[a] No further improvement is expected beyond 2008 for these measures since the current suite of instruments has met their maximum performance level. This target is a measure of SC's intent to maintain the maximum level of performance for users of the current SC facilities until the next generation of instruments and facilities becomes available.

FY 2008	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2009	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2010–FY 2015	T: Cost and schedule variance are both less than 10% A: TBD

Annual Performance Measure: Achieve an average operation time of the scientific user facilities as a percentage of the total scheduled annual operating time of greater than 90%.

FY 2006	T: 90% of scheduled operating time A: Goal met
FY 2007	T: 90% of scheduled operating time A: Goal met
FY 2008	T: 90% of scheduled operating time A: Goal met
FY 2009	T: 90% of scheduled operating time A: Goal met
FY 2010–FY 2015	T: 90% of scheduled operating time A: TBD

Materials Sciences and Engineering
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Materials Sciences and Engineering			
Materials Sciences and Engineering Research	392,260[a]	354,104	421,427
Facilities Operations	689,047[a]	0	0
Other Project Costs	27,044[a]	0	0
SBIR/STTR	0	9,538	11,236
Total, Materials Sciences and Engineering	1,108,351[a]	363,642	432,663

Description

This subprogram supports fundamental experimental and theoretical research to provide the knowledge base for the discovery and design of new materials with novel structures, functions, and properties.

In condensed matter and materials physics—including activities in experimental condensed matter physics, theoretical condensed matter physics, materials behavior and radiation effects, and physical behavior of materials—research is supported to understand, design, and control materials properties and function. These goals are accomplished through studies of the relationship of materials structures to their electrical, optical, magnetic, surface reactivity, and mechanical properties and of the way in which materials respond to external forces such as stress, chemical and electrochemical environments, radiation, and the proximity of materials to surfaces and interfaces.

In scattering and instrumentation sciences—including activities in neutron and x-ray scattering and electron and scanning microscopies—research is supported on the fundamental interactions of photons, neutrons, and electrons with matter to understand the atomic, electronic, and magnetic structures and excitations of materials and the relationship of these structures and excitations to materials properties and behavior.

In materials discovery, design, and synthesis—including activities in synthesis and processing science, materials chemistry, and biomolecular materials—research is supported in the discovery and design of novel materials and the development of innovative materials synthesis and processing methods. This research is guided by applications of concepts learned from the interface between physics and biology and from nano-scale understanding of synthesis and structures.

The Energy Innovation Hub focused on Batteries and Energy Storage will consist of multidisciplinary teams of experts that blend basic scientific research with technology development, engineering design, and energy policy. They will bridge the gap between basic scientific breakthroughs and industrial commercialization through proof-of-concept prototyping, modeling, measurement, and verification of the potential for major impacts.

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[a] FY 2009 funding of $771,198,000 for Scientific User Facilities is located within the Materials Sciences and Engineering Research activity ($82,151,000) and the Facility Operations activity ($689,047,000). In FY 2010 and beyond, this funding is shown in the Scientific User Facilities subprogram.

Selected FY 2009 Accomplishments

- *Encoding Information at Sub-Atomic Scales.* Using state-of-the-art nanoscience instruments and novel techniques, scientists have set a record for the smallest writing, forming letters with features that are one third of a billionth of a meter or 0.3 nanometers. This sub-atomic writing was achieved by using a scanning tunnelling microscope (STM) to precisely position carbon monoxide molecules into a desired pattern on a copper surface. The electrons that move around on the copper surface act as waves that interfere with the carbon monoxide molecules and with each other, forming an interference pattern that depends on the positions of the molecules. By altering the arrangement of the molecules, specific electron interference patterns are created, thereby encoding information for later retrieval. In addition, several data sets can be stored in a single molecular arrangement by using multiple electron energies, one of the variables possible with the STM. The same STM technology can then be used to read the data that has been stored. Because the information is stored in the electron interference pattern, rather than in the individual carbon monoxide molecules or surface copper atoms, the storage density is not limited by the size of an atom. These results demonstrate the feasibility of a new approach capable of achieving sub-atomic data storage.
- *Electronic Liquid Crystal States Discovered in Parent of Iron-Based Superconductor.* In one of the first results from an Energy Frontier Research Center, new insights were gained concerning the electronic structure of iron-based, high-temperature (high-T_c) superconductors. Using a newly developed, highly sensitive scanning tunneling microscope, static nanoscale electronic structures at about eight times the distance between individual iron atoms were observed in a parent material of the iron-based superconductors. These structures were aligned along one crystal axis, reminiscent of the way molecules spatially order in a liquid crystal display. In addition, free electrons were found to move in a direction perpendicular to these aligned 'electronic liquid crystal' states. These findings are similar to observations in cuprate superconductors, a surprise because many theorists had expected the iron-based materials to act more like conventional metal superconductors. This new understanding of electronic structure provides insights to revise theories for the mechanism of high temperature superconductivity.
- *Learning from Nature to Make Tough Ceramics.* Nature generates strong materials, such as mother-of-pearl, with orders of magnitude more fracture resistance than any man-made materials, by forming hybrid composites in which a hard, brittle mineral is combined with soft, organic molecules. Recently, researchers have used sophisticated material control techniques to create a new fabrication process that mimics Nature. The results are hybrid materials composed of aluminum oxide (strong, but brittle) and polymers (soft, organic materials) with toughness 300 times higher than either component alone. To achieve this new material, researchers oriented ceramic layers and interconnected them with bridges to impose molecular control on the bonding between the polymer and ceramics. The processing involved controlled freezing of a suspension of aluminum oxide ceramic particles in water (which drives the particles into layered structures), sublimating the ice, and then infiltrating the remaining ceramic framework with a polymer. The layer orientation and spacing were designed to ensure that a crack that forms in the brittle mineral is shielded from stress and actually stops growing, thereby resulting in the combined high strength and facture resistance.
- *Real-time Observation of Graphene Reconstruction Confirms Predicted Structure.* The world's most powerful transmission electron microscope, developed in the Transmission Electron Aberration-Corrected Microscope (TEAM) project, was used to make the first-ever real-time recordings of the movements of individual carbon atoms in a graphene sheet, providing critical insights on the properties of these unique materials. Graphene is a single atomic layer of graphite that is attracting

significant attention for its unique electronic properties. For example, theory predicts that narrow strips of graphene known as nanoribbons could conduct a current in which all the electrons have the same spin and might therefore serve as the basis for nanosized spintronic devices, electronics based on spin rather than charge. However, this conduction phenomenon is predicted to occur only if the nanoribbons are oriented along a particular direction in the graphene sheet, forming so-called zig-zag edges. The advanced capabilities of the new microscope yielded unprecedented images of individual carbon atoms around the edges of a hole in a suspended graphene sheet and allowed for the real-time observation of edge reconstruction and whole growth. Careful analysis of the time-evolution of the atomic positions and edge structures confirmed that the zig-zag configuration appeared to be the most stable, bolstering optimism for development of graphene-based spintronic devices.

- *Flexible, transparent, and cheaper silicon solar cells.* A novel fabrication strategy has been developed for thin, semi-transparent, lightweight, and flexible solar cells with one-tenth the silicon in current devices and applicable to a variety of substrates including flexible polymer and glass sheets. The process involves fabrication of micron-sized cells on single-crystal silicon wafers and lifting them off using a block of rubbery polymer. These are then printed, or transferred, to the desired substrate; a process that can be repeated many times to build a macro-scale cell. The technique has been used to print cells on flexible, rollable plastic sheets. Respectable solar energy conversion efficiencies of about 12% have been achieved for silicon with thicknesses of 15 microns, thinner than a human hair and less than a tenth the thickness of wafers used in current-generation solar cells. In addition to lower potential cost, this novel solar cell allows unprecedented design characteristics including bendability, lighter weight, and partial transparency, none of which are possible with today's silicon devices.
- *Efficient Solar Hydrogen Production by a Hybrid Photo-Catalyst System.* Inorganic catalyst systems have been used to generate hydrogen from water by use of sunlight, but the efficiency is low because they can only use the UV portion of the solar radiation. Natural photosynthetic systems such as photosystem I (PS-I) can absorb about 45% of the solar spectrum, but are indirectly and inefficiently coupled to a non-robust, oxygen-sensitive hydrogenase enzyme to generate hydrogen. A novel bio-inspired hybrid system for faster and efficient generation of hydrogen from sunlight was developed. The new hybrid system uses a cleverly designed synthetic molecular wire to covalently link PS-I with gold or platinum nanocatalysts. The molecular wire provides a rapid, efficient pathway for shuttling photo-generated electrons to the inorganic nanocatalyst, with electron-transfer rates approaching 75% of the rates in plants. When exposed to sunlight, this new hybrid system generates hydrogen at up to 1,700 times the current benchmark.
- *Large Area, High Density Arrays of Nanopillars Achieved.* Control of the chemical interactions during the self-assembly of arrays of polymer nanopillars has resulted in perfectly ordered arrays over extremely large areas. Researchers controlled the formation of the polymer nano-cylinders, each with unprecedentedly small about 3 nm diameter normal to the substrate during synthesis, the attraction and repulsion between the segments in a block copolymer are balanced against their interaction with the zigzagged surface of the patterned substrate. The new insight was to control the features and the relationships among the substrate pattern, film thickness, and polymer nanopillars. By controlling these relationships, an ordered array of polymer nanopillars was produced with densities in excess of 10^{12} per square inch, more than an order of magnitude greater than previously possible. In a novel application of synchrotron x-ray scattering, the ordering and orientation of the pillars were confirmed to be maintained over the entire surface. This guided synthesis should be applicable to different substrates and block copolymers with built-in electron and optical properties,

opening a versatile route toward ultrahigh density arrays that could be used in photovoltaics, electronics, and information storage applications.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Materials Sciences and Engineering Research	**392,260**	**354,104**	**421,427**
▪ **Experimental Condensed Matter Physics**	**43,584**	**48,264**	**45,966**

This activity supports experimental condensed matter physics emphasizing the relationship between the electronic structure and the properties of complex materials, often at the nanoscale. The focus is on systems whose behavior derives from strong correlation effects of electrons as manifested in superconducting, semi-conducting, magnetic, thermoelectric, and optical properties. Also supported is the development of new techniques and instruments for characterizing the electronic states and properties of materials under extreme conditions, such as in ultra low temperatures (millikelvin), in ultra high magnetic fields (100 Tesla), and at ultrafast time scales (femtosecond). Capital equipment is provided for scanning tunneling microscopes, electron detectors, superconducting magnets, and physical property measurement instruments.

Improving the understanding of the electronic behavior of materials on the atomistic scale is relevant to the DOE mission, as these structures offer enhanced properties and could lead to dramatic improvements in technologies for energy generation, conversion, storage, delivery, and use. Specifically, research efforts in understanding the fundamental mechanisms of superconductivity, the elementary energy conversion steps in photovoltaics, and the energetics of hydrogen storage provide the major scientific underpinnings for the respective energy technologies. This activity also supports basic research in semiconductor and spin-based electronics of interest for the next generation information technology and electronics industries.

In FY 2011, funding will be provided for research in the area of complex and emergent behavior. The research activities will emphasize investigations of emergent behaviors that arise from the collective, cooperative behavior of individual components of a system such as atoms or electrons that lead to physical phenomena as diverse as phase transitions, high temperature superconductivity, colossal magnetoresistance, random field magnets, and spin liquids and glasses. Additional investments will be made for the study of ultracold, atomic Fermi gasses as a means to study interaction effects that are relevant to the understanding of correlation effects in the condensed phase. These phenomena are expected to impact a wide range of energy relevant technologies.

▪ **Theoretical Condensed Matter Physics**	**27,498**	**28,932**	**29,641**

This activity supports theoretical condensed matter physics with emphasis on the theory, modeling, and simulation of electronic correlations. A major thrust is nanoscale science, where links between the electronic, optical, mechanical, and magnetic properties of nanostructures and their size, shape, topology, and composition are poorly understood. Other major research areas include strongly correlated electron systems, quantum transport, superconductivity, magnetism, and optics. Development of theory targeted at aiding experimental technique design and interpretation of experimental results is also emphasized. This activity supports the Computational Materials Science Network, which forms collaborating teams from diverse disciplines to address the increasing complexity of many current research issues. The activity also supports large-scale computation to perform complex calculations dictated by fundamental theory or to perform complex system simulations with joint funding from the Advanced Scientific Computing Research program. Capital equipment funding will be provided for items such as computer workstations and clusters.

This activity provides the fundamental knowledge for predicting the reliability and lifetime of energy use and conversion approaches and develops opportunities for next generation energy technology. Specific examples include inverse design of compound semiconductors for unprecedented solar photovoltaic conversion efficiency, solid-state approaches to improving capacity and kinetics of hydrogen storage, and ion transport mechanisms for fuel cell applications.

In FY 2011, this activity will increase the support of collaborative research activities focused on enhancing the understanding of the nature and origin of highly correlated states in strongly interacting systems that have spin, charge, lattice, and orbital degrees of freedom and that are often intrinsically inhomogeneous on nanometer length scales. Research will include both theoretical and computational approaches capable of interrogating systems to gain direct insight on the mechanisms that lead to cooperative behavior.

	FY 2009	FY 2010	FY 2011
▪ **Mechanical Behavior and Radiation Effects**	**17,830**	**20,666**	**25,172**

This activity supports basic research to understand defects in materials and their effects on the properties of strength, structure, deformation, and failure. Defect formation, growth, migration, and propagation are examined by coordinated experimental and modeling efforts over a wide range of spatial and temporal scales. Topics include deformation of ultra-fine scale materials, radiation-resistant material fundamentals, and intelligent microstructural design for increased strength, formability, and fracture resistance in energy relevant materials. The goals are to develop predictive models for the design of materials having superior mechanical properties and radiation resistance. Capital equipment funding is provided for microstructural analysis, nanoscale mechanical property measurement tools, and ion-beam processing instrumentation.

The ability to predict materials performance and reliability and to address service life extension issues is important to the DOE mission areas of robust energy storage systems; fossil, fusion, and nuclear energy conversion; radioactive waste storage; environmental cleanup; and defense. Among the key materials performance goals for these technologies are good load-bearing capacity, failure and fatigue resistance, fracture toughness and impact resistance, high-temperature strength and dimensional stability, ductility and deformability, and radiation tolerance. Since materials from large-scale nuclear reactor components to nanoscale electronic switches undergo mechanical stress and may be subjected to ionizing radiation, this activity provides the fundamental scientific underpinning to enable the advancement of high-efficiency and safe energy generation, use, and storage as well as transportation systems.

In FY 2011, this activity will support research on the properties of materials in extreme environments such as the exposure to an energetic flux, chemical reactive stimulants, high temperature and pressure, and high magnetic and electric fields. The primary emphasis will be on discovering novel phenomena and materials for improved performance with superior functionality and to establish unified models to predict the mechanical and degradation behavior of solids over multiple length and time scales. Additional research will be initiated to focus on understanding the complex interactions of radiation-induced defects with microstructure, and their effects on the

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

functionalities of materials under extreme conditions, including those that exist in nuclear reactor environments. The research will focus on understanding, modeling, and designing radiation-resistant materials that maintain all of the required physical properties after prolonged exposure. In situ experiments will be closely integrated with theoretical/computational efforts to develop a fundamental understanding of degradation mechanisms and kinetics over multiple length and time scales, from atomistic to micron and nanoseconds to decades.

▪ **Physical Behavior of Materials**	**30,579**	**32,888**	**34,034**

This activity supports basic research on the behavior of materials in response to external stimuli, such as temperature, electromagnetic fields, chemical environments, and the proximity effects of surfaces and interfaces. Emphasis is on the relationships between performance (such as electrical, magnetic, optical, electrochemical, and thermal performance) and the microstructure and defects in the material. Included within the activity are research to establish the relationship of crystal defects to semiconducting, superconducting, and magnetic properties; phase equilibria and kinetics of reactions in materials in hostile environments; and diffusion and transport phenomena. Basic research is also supported to develop new instrumentation, including *in situ* experimental tools, and to probe the physical behavior in real environments encountered in energy applications. Capital equipment funding is provided for items such as physical property measurement tools that include spectroscopic and analytical instruments for chemical and electrochemical analysis.

The research supported by this activity is necessary for improving materials reliability in chemical, electrical, and electrochemical applications and for improving the ability to generate and store energy in materials. Materials in energy-relevant environments are increasingly being exposed to extreme temperatures, strong magnetic fields, and hostile chemical conditions. A detailed understanding of how materials behavior is linked to the surroundings and treatment history is critical to the understanding of corrosion, photovoltaics, fast-ion conducting electrolytes for batteries and fuel cells, novel magnetic materials for low magnetic loss power generation, magnetocaloric materials for high-efficiency refrigeration, and new materials for high-temperature gasification.

In FY 2011, this activity will support research on the fundamental science of photon-matter interactions, which is likely to play a significant role in the development of metamaterials and nano-plasmonics—materials that are expected to be extremely important for the development of technologies that enable low cost power conversion. The research will also include the search for photoconversion materials, such as polycrystalline, nanocrystalline, and organic materials to replace expensive single crystals; innovative design of interpenetrating photoconversion materials networks to improve charge separation and collection efficiency; and the development of novel processes to obtain extremely high photo-conversion efficiencies. This activity also includes funding for the U.S.-India Clean Energy Research Center.

▪ **Neutron and X-ray Scattering**	**44,619**	**38,678**	**42,266**

This activity supports basic research on the fundamental interactions of photons and neutrons with matter to achieve an understanding of the atomic, electronic, and magnetic structures and excitations of materials and the relationships of these structures and excitations to materials properties. The main emphasis is on x-ray and neutron scattering, spectroscopy, and imaging research, primarily at major BES-supported user facilities. The development and improvement of next-generation instrumentation, novel detectors, sample environments, data analysis, tools, and technology for producing polarized neutrons are key aspects of this activity. Instrumentation development and experimental research in ultrafast materials science, including research aimed at generating, manipulating, and detecting ultrashort and ultrahigh-peak-power electron, x-ray, and laser pulses to study ultrafast physical phenomena in materials, is an integral part of the portfolio. Capital equipment funding is provided for items such as detectors, monochromators, focusing mirrors, and beamline instrumentation at the facilities.

The increasing complexity of DOE mission-relevant materials such as superconductors, semiconductors, and magnets requires ever more sophisticated scattering techniques to extract useful knowledge and to develop new theories for the behavior of these materials. X-ray and neutron scattering probes are some of the primary tools for characterizing the atomic, electronic, and magnetic structures of materials. Additionally, neutrons play a key role in hydrogen research as they provide atomic- and molecular-level information on structure, diffusion, and interatomic interactions for hydrogen. They also allow access to the morphologies that govern useful properties in catalysts, membranes, proton conductors, and hydrogen storage materials. The activity is relevant to the behavior of matter in extreme environments, especially at high pressure.

In FY 2011, scattering research will take advantage of increased neutron and x-ray fluxes and optimized beamline optics at BES user facilities, combined with specialized instrumentation, to investigate electrochemical processes in real time. Emphasis will be on using elastic and inelastic neutron scattering to determine structure and local dynamics and on neutron reflectivity to examine electrode/electrolyte interfaces. Time-resolved measurements will be used to study phase transformation kinetics in both amorphous and crystalline phases. The new capabilities will be used to study materials under ultrahigh pressure and to identify novel phase and phenomena not accessible via ambient conditions. Increased emphasis will be placed on expansion of ultrafast materials science research to take advantage of new x-ray and neutron sources to perform research designed to understand dynamic phenomena in real-time, including the physics of strongly correlated systems, such as high temperature superconductors and magnetic materials with colossal magnetoresistance.

	FY 2009	FY 2010	FY 2011
▪ **Electron and Scanning Probe Microscopies**	**22,199**	**26,811**	**27,468**

This activity supports basic research in condensed matter physics and materials physics using electron scattering and microscopy and scanning probe techniques. The research includes experiments and theory to understand the atomic, electronic, and magnetic structures of materials. This activity also supports the development and improvement of electron scattering and scanning probe instrumentation and techniques, including ultrafast diffraction and imaging techniques. Capital equipment funding is provided for items such as new scanning probes and electron microscopes as well as ancillary equipment including high resolution detectors.

Performance improvements for environmentally acceptable energy generation, transmission, storage, and conversion technologies likewise depend on a detailed understanding of the structural characteristics of advanced materials. Electron and scanning probe microscopies are some of the primary tools for characterizing the atomic, electronic, and magnetic structures of materials. The activity is relevant to hydrogen research through the structural determination of nanostructured materials for hydrogen storage and solar hydrogen generation.

In FY 2011, research will emphasize the development of tools that will dramatically improve spatial, time, and energy resolution to provide fundamental understanding of the electron and charge transfer processes and mechanisms by which ions interact with electrode materials. The effort will focus studies of transient non-equilibrium nanoscale structures, including adsorbed species in both vacuum and electrochemical environments, with near-atomic spatial resolution and at the femtosecond time scale. Ultrafast electron scattering will be developed as a companion tool to ultrafast photon probes.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **Experimental Program to Stimulate Competitive Research (EPSCoR)**	**16,755**	**21,623**	**8,635**

This activity supports basic research spanning the broad range of science and technology programs at DOE in states that have historically received relatively less Federal research funding. The EPSCoR states are shown in the table below. The research supported by EPSCoR includes materials sciences, chemical sciences, physics, energy-relevant biological sciences, geological and environmental sciences, high energy physics, nuclear physics, fusion energy sciences, advanced computing, and the basic sciences underpinning fossil energy, nuclear energy and energy efficiency and renewable energy.

The core activity interfaces with all other core activities within the Office of Science. It is also responsive and supports the DOE mission in the areas of energy and national security and in mitigating their associated environmental impacts.

In FY 2011 efforts will continue spanning DOE missions in the Office of Science and science underpinning a number of technology programs including Fossil Energy, Nuclear Energy, and Energy Efficiency and Renewable Energy and enhancing collaboration between programs and collaboration with DOE user facilities. The FY 2011 request will continue basic research related to DOE mission areas and will enhance collaborative efforts with DOE user facilities. The FY 2011 request reflects a decrease due to the additional funding provided by Congress in FY 2010 (-$13,103,000), and provides a funding increase for EPSCoR base amount at the same rate as BES core research (+$115,000). Additional funds provided in FY 2010 were used, to the extent possible, to fully fund grants and minimize outyear mortgages.

The following table shows EPSCoR distribution of funds by state.

EPSCoR Distribution of Funds by State

	FY 2009	FY 2010	FY 2011
Alabama	1,305	0	585
Alaska	810	0	0
Arkansas	0	0	0
Delaware	1,861	0	0
Hawaii	0	0	0
Idaho	1,445	0	0

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Iowa[a]	0	0	0
Kansas	0	0	0
Kentucky	700	650	0
Louisiana	490	300	0
Maine	700	0	0
Mississippi	0	0	0
Montana	410	450	0
Nebraska	825	0	0
Nevada	0	0	0
New Hampshire	646	0	0
New Mexico	272	750	0
North Dakota	1,200	0	0
Oklahoma	1,175	0	0
Puerto Rico	400	450	0
Rhode Island	0	0	0
South Carolina	1,670	0	0
South Dakota	0	0	0
Tennessee	204	314	0
U.S. Virgin Islands	0	0	0
Utah[b]	0	0	0
Vermont	0	0	0
West Virginia	1,605	0	600
Wyoming	405	0	0
Technical Support	632	250	400
Other[c]	0	18,459	7,050

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[a] Iowa became eligible in FY 2009.
[b] Utah became eligible in FY 2009.
[c] Uncommitted funds in FY 2010 and FY 2011 will be competed among all EPSCoR states.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **Synthesis and Processing Science**	**19,473**	**22,220**	**32,764**

This activity supports basic research for developing new techniques to synthesize materials with desired structure, properties, or behavior; to understand the physical phenomena that underpin materials synthesis such as diffusion, nucleation, and phase transitions; and to develop *in situ* monitoring and diagnostic capabilities. The emphasis is on the synthesis of complex thin films and nanoscale materials with atomic layer-by-layer control; preparation techniques for pristine single crystal and bulk materials with novel physical properties; understanding the contributions of the liquid and other precursor states to the processing of bulk nanoscale materials; and low energy processing techniques for large scale nanostructured materials. The focus of this activity on bulk synthesis and crystal and thin films growth via physical means is complementary to the Materials Chemistry and Biomolecular Materials activity, which emphasizes chemical and biomimetic routes to new materials synthesis and design. Capital equipment funding is provided for crystal growth apparatus, heat treatment furnaces, lasers, chemical vapor deposition and molecular beam epitaxial processing equipment, plasma and ion sources, and deposition instruments.

Synthesis and processing science is a key component in the discovery and design of a wide variety of energy relevant materials. In this regard, the activity supports DOE's mission in the synthesis of wide bandgap semiconductors for solid state lighting; light-weight metallic alloys for efficient transportation; novel materials such as metal organic frameworks for hydrogen storage; and structural ceramics and the processing of high temperature superconductors for near zero-loss electricity transmission. The research activity aims at providing synthesis and processing capabilities to enable the manipulation of individual spin, charge, and atomic configurations in ways to probe the atomistic basis for materials properties.

In FY 2011, research will seek to develop novel design rules for synthesizing nanostructured materials and assemblies for applications including solid-state lighting, solar energy conversion, hydrogen storage and electrical energy storage. Research on advanced materials for electrical energy storage will include studies on the fundamental electrochemical characteristics of nanoscale building blocks with varying size and shape and in confined geometry. The development of new capabilities for synthesis will be emphasized including novel crystal growth techniques that will expand our ability to discover needed materials for advanced energy technologies, as well as to facilitate our understanding of new phenomena in energy generation and transport, including superconductivity, photovoltaics, and energy storage.

▪ **Materials Chemistry and Biomolecular Materials**	**52,373**	**52,265**	**63,461**

This activity supports basic research in chemical and bio-inspired synthesis and discovery of new materials. In the materials chemistry area, discovery, design, and synthesis of novel materials with an emphasis on the chemistry and chemical control of structure and collective properties are supported. Major thrust areas include nanoscale chemical synthesis and assembly; solid state chemistry for exploratory synthesis and tailored reactivities; novel polymeric materials; surface and interfacial chemistry including electrochemistry; and the development of new, science-driven, laboratory-based analytical tools and techniques. In the biomolecular materials area, research supported includes biomimetic and bioinspired functional materials and complex structures, and materials aspects of energy conversion processes based on principles and concepts of biology. The focus on exploratory

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

chemical and biomolecular formation of new materials is complementary to the emphasis on bulk synthesis, crystal growth, and thin films in the Synthesis and Processing Science activity. Capital equipment funding is provided for items such as advanced nuclear magnetic resonance and magnetic resonance imaging instruments and novel scanning probe microscopes.

Research supported in this activity underpins many energy-related technological areas such as batteries and fuel cells, catalysis, energy conversion and storage, friction and lubrication, high-efficiency electronic devices, hydrogen generation and storage, light-emitting materials, light-weight high-strength materials, and membranes for advanced separations.

In FY 2011, emphasis will be on developing a predictive understanding of the role of interfaces in the electrochemical processes underpinning energy storage technologies, devising experimental strategies for atom-by-atom synthesis or molecular assembly of structures for new storage materials, and exploring novel concepts for electrical and electrochemical energy storage. The research will seek to advance the ability for materials to self-repair, regulate, clean, sequester impurities, and tolerate abuse which will ultimately improve their performance. Expanded research to understand carbon capture phenomena will be initiated, including investigation of novel chemical and biomimetic approaches for efficient carbon capture and release. Kinetics for both carbon capture and release will be investigated in environments that include the contaminants found in flue gases. Nanoscale hybrid materials and advances in the understanding of photosynthetic and catalytic systems will be used to study inorganic/organic components in engineered assemblies to produce new materials for the conversion of solar photons to fuels and chemicals. In addition, an increased emphasis will be on bio-inspired materials discovery—linking physical and chemical synthesis with the synthesis strategies of biology, which can be extended to create new materials *in vitro* with altered morphologies and desired materials properties. Biological self-assembly occurs on both spatial and temporal scales, controlled to provide function that can change dynamically. In addition, biological self-assembly can be reversible and result in complex structures that are far from equilibrium, opening new avenues to materials with emergent behaviors. The challenge is to understand the biological self-assembly and translate these into new methods for physical and chemical growth of materials.

	FY 2009	FY 2010	FY 2011
▪ **Energy Frontier Research Centers (EFRCs)**[a]	**58,000**	**58,000**	**78,000**

The 46 EFRCs established in late FY 2009 are multi-investigator and multi-disciplinary centers that foster, encourage, and accelerate basic research to provide the basis for transformative energy technologies of the future.[b] The EFRCs represent an important new research modality for BES, bringing together the skills and talents of a critical mass of investigators to enable energy relevant, basic research of a scope and complexity that would not be possible with the standard single-investigator or small-group award. The scope and unique nature of the EFRC program requires special oversight, which is accomplished through a BES-wide, dedicated EFRC management team.

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[a] A complimentary set of EFRCs is also included in the Chemical Sciences, Geosciences, and Energy Biosciences subprogram. This set includes ongoing EFRCs as well as new awards to be initiated in FY 2011.

[b] 16 of the 46 EFRCs were forward funded for the five-year initial award period under the American Recovery and Reinvestment Act of 2009.

This team has the direct management responsibility over all EFRCs and also coordinates EFRC research with the complementary research conducted within the BES core research areas.

This activity supports those EFRCs that are best coordinated with and most suitably complement the ongoing core research activities within the Materials Science and Engineering subprogram. In general terms, these EFRCs are focused on the design, discovery, synthesis, and characterization of novel, solid-state materials that improve the conversion of solar energy and heat into electricity; that improve the conversion of electricity to light; that can be used to improve electrical energy storage; that are resistant to corrosion, decay, or failure in extreme conditions of temperature, pressure, radiation, or chemical exposures; that take advantage of emergent phenomena, such as superconductivity, to improve energy transmission; that optimize energy flow to improve energy efficiency; and that are tailored at the atomic level for catalytic activity.

In FY 2011, new EFRCs will be solicited in two categories: discovery and development of new materials that are critical to both science frontiers and technology innovations, and basic research for energy needs in a limited number of areas that are underrepresented in the 46 original EFRC awards.

For the discovery and development of new materials, the emphasis will be on new synthesis capabilities, including advanced crystal growth techniques that will expand our ability to discover new materials for advanced energy technologies, as well as to drive our understanding of new phenomena in energy generation and transport, including superconductivity, photovoltaics, and energy storage. The expansion of synthesis capabilities in the EFRC modality will enable the development of a stronger culture of discovery-based research, and enhance the scientific and intellectual manpower in this critical area for science and technology. BES will foster this community to link the synthesis of materials with experimental research to discover new phenomena and to solve energy-related challenges, as well as integrating materials synthesis with advanced theoretical research to model and predict materials behavior, accelerating the rate of materials discovery.

For research for energy applications, areas of emphasis include: fundamental science of carbon capture, including the rational design of novel materials and separation processes for post-combustion CO_2 capture and fundamental science for advanced nuclear energy systems, e.g., radiation resistant materials in fission and fusion applications. EFRC research will focus on interdisciplinary team approaches to develop the scientific understanding to enable new, low energy routes to carbon capture/release including the discovery of new chemical, bioinspired, and materials approaches. For nuclear energy systems, EFRC research will couple understanding of radiation effects with other extreme conditions and will establish a greater breadth in multiscale modeling of physical behavior at a systems level.

	FY 2009	FY 2010	FY 2011
▪ **Energy Innovation Hub—Batteries and Energy Storage**	**0**	**0**	**34,020**

As an energy carrier, electricity has no rival with regard to its environmental cleanliness, flexibility in interfacing with multiple production sources and end uses, and efficiency of delivery. Electrical energy storage offers one of the most significant solutions to the effective use of electricity in energy management. Improved energy storage is critical for load-leveling and peak-shaving for more efficient and reliable smart electric grid technologies; plug-in hybrid or all-electric vehicles in the transportation sector; and the deployment of intermittent renewable energy power sources such as solar, wind, and wave energy into the utility sector. Today's electrical energy storage approaches, such as batteries and electrochemical devices, suffer from limited energy and power capacities, lower-than-desired rates of charge and discharge, calendar and cycle life limitations, low abuse tolerance, high cost, and poor performance at high or low temperatures. These performance deficiencies adversely affect the successful use and integration of renewable, intermittent power sources such as solar, wind, and wave energy into the utility sector. These same fundamental problems have also limited broad consumer acceptance and market adaptation of hybrid and all-electric vehicles.

Recent developments in nanoscience and nanotechnology offer tantalizing clues on promising scientific directions that may enable conceptual breakthroughs. They include the abilities to synthesize novel nanoscale materials with architectures tailored for specific electrochemical performance, to characterize materials and dynamic chemical processes at the atomic and molecular level, and to simulate and predict structural and functional relationships using modern computational tools. Based on this, radically new concepts in materials design can be developed for producing storage devices with materials that are abundant and low in manufacturing cost, are capable of storing higher energy densities, have long cycle lifetimes, and have high safety and abuse tolerance.

Together, these new capabilities provide the potential for addressing the gaps in cost and performance separating the current electrical energy storage technologies and those required for sustainable utility and transportation needs.

Fundamental performance limitations of energy storage systems are rooted in the constituent materials making up an electrical energy storage device, and novel approaches are needed to develop multifunctional electrical energy storage materials that offer new self-healing, self-regulating, failure-tolerant, impurity-sequestering, and sustainable characteristics. The Hub would address a number of specific areas of research for both batteries and electrochemical capacitors that have been identified in the BES workshop report *Basic Research Needs for Electrical Energy Storage*. These include:

- Efficacy of structure in energy storage—new approaches combining theory and synthesis for the design and optimization of materials architectures including self-healing, self-regulation, failure-tolerance, and impurity sequestration.
- Charge transfer and transport—molecular scale understanding of interfacial electron transfer.
- Electrolytes—electrolytes with strong ionic solvation, yet weak ion-ion interactions, high fluidity, and controlled reactivity.
- Probes of energy storage chemistry and physics at all time and length scales—analytical tools capable of monitoring changes in structure and composition at interfaces and in bulk phases with spatial resolution from atomic to mesoscopic levels and temporal resolution down to femtoseconds.
- Multi-scale modeling—computational tools with improved integration of length and time scales to understand the complex physical and chemical processes that occur in electrical energy storage processes from the molecular to system scales.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

One-time funding of $10,000,000 will be provided for Hub start-up needs, excluding new construction.

- **General Plant Projects (GPP)** **4,243** **3,757** **0**

  GPP funding is provided for the Stanford Institute for Materials and Energy Sciences (SIMES) project. This GPP project will renovate space for SIMES. Phase I prepares currently vacant space in Building 40 for build-out by upgrading the area to current ADA compliance and construction of common space. Phase II builds out the SIMES laboratories and renovates SIMES office and interaction space in Building 40. The TEC for this project is $8,000,000. No funds are requested in FY 2011.

- **Electron-beam Microcharacterization** **11,313** **0** **0**

  This activity supports three electron-beam microcharacterization centers, which operate as user facilities, work to develop next-generation electron-beam instrumentation, and conduct corresponding research. These centers are the Electron Microscopy Center for Materials Research at Argonne National Laboratory (ANL), the National Center for Electron Microscopy at Lawrence Berkeley National Laboratory (LBNL), and the Shared Research Equipment program at Oak Ridge National Laboratory (ORNL).

  Beginning in FY 2010, this research is budgeted for in a separate subprogram, within the Basic Energy Sciences program, entitled "Scientific User Facilities."

- **Accelerator and Detector Research** **9,794** **0** **0**

  This activity supports basic research in accelerator physics and x-ray and neutron detectors. Accelerator research is the corner stone for the development of new technologies that will improve performance of our light sources and neutron spallation facilities. This research will explore new areas of science and technologies that will facilitate the construction of our next generation accelerator-based user facilities. Detector research is a crucial, but often overlooked, component in the optimal utilization of our user facilities. This research program is investing aggressively in research leading to a new and more efficient generation of photon and neutron detectors.

  Beginning in FY 2010, this research is budgeted for in a separate subprogram, within the Basic Energy Sciences program, entitled "Scientific User Facilities."

- **Spallation Neutron Source Instrumentation I (SING I)** **12,000** **0** **0**

  Funds support a Major Item of Equipment to fabricate five instruments for the Spallation Neutron Source (SNS).

  Beginning in FY 2010, this research is budgeted for in a separate subprogram, within the Basic Energy Sciences program, entitled "Scientific User Facilities."

- **Spallation Neutron Source Instrumentation II (SING II)** **7,000** **0** **0**

  Funds support a Major Item of Equipment to fabricate four instruments to be installed at the SNS.

  Beginning in FY 2010, this research is budgeted for in a separate subprogram, within the Basic Energy Sciences program, entitled "Scientific User Facilities."

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ **Linac Coherent Light Source Ultrafast Science Instruments (LUSI)**	**15,000**	**0**	**0**

Funds support a Major Item of Equipment for three instruments for the Linac Coherent Light Source (LCLS) that will be installed after the LCLS line item project is completed in FY 2010. The technical concepts for the three instruments have been developed in consultation with the scientific community through a series of workshops, conferences, and focused review committees. Instrument designs for the LUSI project have been competitively selected using a peer review process. The project is managed by the SLAC National Accelerator Laboratory. It is anticipated that these three instruments will be installed at the LCLS on a phased schedule between FY 2010–2012. The baseline TPC was approved at Approve Performance Baseline, CD-2. The project is fully funded as of FY 2009.

Facilities Operations	**689,047**	**0**	**0**

This activity supports the operation of the BES scientific user facilities, which consist of light sources, neutron sources, nanoscience centers, and the Linac Coherent Light Source Free Electron Laser at SLAC.

Beginning in FY 2010, Facilities Operations is budgeted for in a separate subprogram, within the Basic Energy Sciences program, entitled "Scientific User Facilities." The number of users and operating hours for the synchrotron radiation sources and neutron scattering facilities are shown in the Scientific User Facilities subprogram.

▪ **Synchrotron Radiation Light Sources**	**338,755**	**0**	**0**
Advanced Light Source, LBNL	55,728	0	0
Advanced Photon Source, ANL	116,440	0	0
National Synchrotron Light Source, BNL	40,154	0	0
Stanford Synchrotron Radiation Light Source, SLAC	33,412	0	0
Linac Coherent Light Source (LCLS), SLAC	3,000	0	0
Linac for LCLS, SLAC	90,021	0	0
▪ **High-Flux Neutron Sources**	**249,802**	**0**	**0**
High Flux Isotope Reactor, ORNL	58,000	0	0
Intense Pulsed Neutron Source, ANL	4,000	0	0
Manuel Lujan, Jr. Neutron Scattering Center, LANL	11,302	0	0
Spallation Neutron Source, ORNL	176,500	0	0
▪ **Nanoscale Science Research Centers (NSRCs)**	**100,490**	**0**	**0**
Center for Nanophase Materials Sciences, ORNL	19,900	0	0
Center for Integrated Nanotechnologies, SNL/LANL	19,950	0	0

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Molecular Foundry, LBNL	20,000	0	0
Center for Nanoscale Materials, ANL	20,640	0	0
Center for Functional Nanomaterials, BNL	20,000	0	0
Other Project Costs	**27,044**	**0**	**0**

Other Project Costs (OPC) are associated with line-item construction or major item of equipment projects and include all project costs that are not identified as Total Estimated Cost costs. Total Estimated Cost includes project costs incurred after Critical Decision-1 such as costs associated with the acquisition of land and land rights; engineering, design, and inspection; direct and indirect construction/fabrication; and the initial equipment necessary to place the plant or installation in operation. Generally, OPC are costs incurred during the project's initiation and definition phase for planning, conceptual design, research and development, and during the execution phase for research and development, startup and operation. Other Project Costs are always operating funds.

	FY 2009	FY 2010	FY 2011
▪ Advanced Light Source User Support Building, LBNL	4	0	0
▪ Linac Coherent Light Source, SLAC	17,000	0	0
▪ National Synchrotron Light Source-II, BNL	10,000	0	0
▪ Photon Ultrafast Laser and Science and Engineering Building Renovation, SLAC	40	0	0
SBIR/STTR	**0**	**9,538**	**11,236**

In FY 2009, $25,592,000 and $3,071,000 were transferred to the SBIR and STTR programs, respectively. The FY 2010 and FY 2011 amounts shown are the estimated requirements for the continuation of the congressionally mandated SBIR and STTR program.

	FY 2009	FY 2010	FY 2011
Total, Materials Sciences and Engineering	**1,108,351**	**363,642**	**432,663**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Materials Sciences and Engineering Research	
▪ **Experimental Condensed Matter Physics**	
Increased funding is provided for enhanced research in the area of complex and emergent behavior (+$1,104,000). No direct funding is planned in FY 2011 for pension payments at ORNL and LBNL (-$3,402,000).	-2,298
▪ **Theoretical Condensed Matter Physics**	
Increased funding is provided for enhanced research to support multi-investigator projects in theory and modeling and simulation.	+709

	FY 2011 vs. FY 2010 ($000)
▪ **Mechanical Behavior and Radiation Effects**	
Increased funding is provided for enhanced research on the properties of materials in extreme environments such as the exposure to an energetic flux, chemical reactive stimulants, high temperature and pressure, and high magnetic and electric fields.	+4,506
▪ **Physical Behavior of Materials**	
Increased funding is provided for enhanced research on the fundamental science of photon-matter interactions.	+1,146
▪ **Neutron and X-ray Scattering**	
Increased funding is provided for scattering research to take advantage of increased neutron and x-ray fluxes and optimized beamline optics at BES user facilities, combined with specialized instruments, to investigate electrochemical processes in real time (+$1,088,000). Increased emphasis will be placed on expansion of ultrafast materials science research to take advantage of new x-ray and neutron sources to perform research on dynamic phenomena in real-time (+$2,500,000).	+3,588
▪ **Electron and Scanning Probe Microscopies**	
Increased funding is provided to emphasize the development of tools that will dramatically improve spatial, time, and energy resolution to provide fundamental understanding of the electron and charge transfer processes and mechanisms by which ions interact with electrode materials.	+657
▪ **Experimental Program to Stimulate Competitive Research (EPSCoR)**	
The FY 2011 decrease is a result of the additional funding provided by Congress in FY 2010 (-$13,103,000); EPSCoR, funding increases at the same rate as BES core research (+$115,000). Additional funds provided in FY 2010 were used, to the extent possible, to fully fund grants and minimize outyear mortgages.	-12,988
▪ **Synthesis and Processing Science**	
Increased funding is provided to develop novel design rules for synthesizing nanostructured materials and assemblies for use-inspired technologies including solid state lighting, solar energy conversion, hydrogen storage, and electrical energy storage.	+10,544
▪ **Materials Chemistry and Biomolecular Materials**	
Increased funding is provided for research on the design and synthesis of new energy relevant materials and processes which includes those inspired by biology for new three-dimensional nanostructured architectures that can be precisely tailored for advanced energy storage and novel chemistries and materials for carbon capture.	+11,196

	FY 2011 vs. FY 2010 ($000)
- **Energy Frontier Research Centers**	
Increased funding is provided for research in discovery and development of new materials and energy related research topics.	+20,000
- **Energy Innovation Hub – Batteries and Energy Storage**	
Funds are provided for an Energy Innovation Hub focused on developing radically new concepts in materials design for producing storage devices with materials that are abundant and low in manufacturing cost, are capable of storing higher energy densities, have long cycle lifetimes, and have safety and abuse tolerance.	+34,020
- **General Plant Projects (GPP)**	
No GPP funding is requested in FY 2011. The SIMES project is complete in FY 2010.	-3,757
Total, Materials Sciences and Engineering Research	**+67,323**
SBIR/STTR	
Increased funding in SBIR/STTR funding because of an increase in total operating expenses.	+1,698
Total Funding Change, Materials Sciences and Engineering	**+69,021**

Chemical Sciences, Geosciences, and Energy Biosciences

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Chemical Sciences, Geosciences, and Energy Biosciences			
Chemical Sciences, Geosciences, and Energy Biosciences Research	281,946	288,978	393,131
SBIR/STTR	0	7,956	10,485
Total, Chemical Sciences, Geosciences, and Energy Biosciences	281,946	296,934	403,616

Description

This subprogram supports experimental, theoretical, and computational research to provide fundamental understanding of chemical transformations and energy flow in systems relevant to DOE missions. This knowledge serves as a basis for the development of new processes for the generation, storage, and use of energy and for mitigation of the environmental impacts of energy use.

In fundamental interactions, basic research is supported in atomic, molecular, and optical sciences; gas-phase chemical physics; ultrafast chemical science; theoretical and computational chemistry; and condensed phase and interfacial molecular science. Emphasis is placed on structural and dynamical studies of atoms, molecules, and nanostructures, and the description of their interactions in full quantum detail, with the aim of providing a complete understanding of reactive chemistry in the gas phase, condensed phase, and at interfaces. Novel sources of photons, electrons, and ions are used to probe and control atomic, molecular, and nanoscale matter. Ultrafast optical and x-ray techniques are developed and used to study and direct molecular, dynamics, and chemical reactions.

In photochemistry and biochemistry, including solar photochemistry, photosynthetic systems, and physical biosciences, research is supported on the molecular mechanisms involved in the capture of light energy and its conversion into chemical and electrical energy through biological and chemical pathways. Natural photosynthetic systems are studied to create robust artificial and bio-hybrid systems that exhibit the biological traits of self assembly, regulation, and self repair. Complementary research encompasses organic and inorganic photochemistry, photo-induced electron and energy transfer, photo-electrochemistry, and molecular assemblies for artificial photosynthesis.

In chemical transformations, research themes include the characterization, control, and optimization of chemistry in many forms, including catalysis; separations and analysis; actinide chemistry; and geosciences. Catalysis science underpins the design of new catalytic methods for the clean and efficient production of fuels and chemicals and emphasizes inorganic and organic complexes; interfacial chemistry, nanostructured and supramolecular catalysts, photocatalysis and electrochemistry, and bio-inspired catalytic processes. Heavy element chemistry focuses on the spectroscopy, bonding, and reactivity of actinides and fission products. Complementary research on chemical separations focuses on the use of nanoscale membranes and the development of novel metal-adduct complexes. Chemical analysis research emphasizes laser-based and ionization techniques for molecular detection, particularly the development of chemical imaging techniques. Geosciences research covers analytical and physical geochemistry, rock-fluid interactions, and flow/transport phenomena.

The Energy Innovation Hub focused on Fuels from Sunlight will consist of multidisciplinary teams of experts that blend basic scientific research with technology development, engineering design, and energy policy. They will bridge the gap between basic scientific breakthroughs and industrial commercialization through proof-of-concept prototyping, modeling, measurement, and verification of the potential for major impacts.

Selected FY 2009 Accomplishments

- *Controlling x-rays with light.* The advent of x-ray free electron lasers and laser-based x-ray sources is enabling a rapidly expanding frontier of ultrafast x-ray science. A central application of these new sources is the visualization of atomic, molecular, and electronic dynamics, as triggered by an ultrafast light pulse, on atomic time and length scales. In such studies, visible light is used to modify the target and x-rays are used to monitor the response. Researchers have demonstrated for the first time that visible light pulses can also be used for a fundamentally different purpose—to control x-ray interactions with matter. Through an effect known as electromagnetically induced transparency, intense visible light can be used to induce transparency in a material that normally is opaque to x-ray radiation due to resonant x-ray absorption. The induced transparency is ultrafast and reversible and functions as an ultrafast x-ray switch. The ability to control x-ray/matter interactions with visible light will create new research opportunities at current and next-generation x-ray light sources. These results will also form a foundation for planned experiments at the Linac Coherent Light Source, in which intense x-rays will be used to both control and probe matter.
- *New tools for understanding interfacial chemistry.* The interactions of atoms and molecules at gas-solid and liquid-solid interfaces are critical in areas including heterogeneous catalysis, electrical energy storage, and solar energy conversion. The study of chemical interactions at surfaces at the molecular level is profoundly difficult because of the small amount of material available for study, the small spatial scales in which the interactions occur, and the ultrafast time scales over which they take place. Recent advances in low-temperature scanning tunneling microscopy (STM) have been combined with temporally and spatially resolved spectroscopic tools such as ultrafast, two-photon photoemission, to enable important new discoveries. New, long-lived electronic surface states have been discovered that could lead to new ways to induce and control electronic excitation at surfaces. Positioning the tip during STM measurements of light emission from single molecules with sub-nanometer resolution yields an unprecedented view of the coupling of electronic and vibrational motion within a single molecule. These new experimental tools are being combined with modern theoretical and computational methods to provide unprecedented capability to predict, monitor, and control the flow of energy and chemical reactivity at interfaces.
- *Understanding the Earth's geochemistry at the nanoscale.* Minerals and mineral composites coexist in the environment with a variety of inorganic and organic molecules, naturally buffering the chemistry of the natural environment. The behavior of water molecules surrounding nanoparticles in subsurface environments is thought to be an important influence on their growth and may account for the strong variation in surface chemistry with particle size. New research demonstrates that the size and shape of mineral particles controls the structure of the first few layers of water on their surfaces, profoundly influencing geochemical reactivity. The residence time of water molecules near the surface is shorter for smaller, less-crystalline nanoparticles than for larger nanoparticles or for the bulk mineral surface. Particles with facets or low curvature tend to preferentially stabilize the water network and in some cases cause faceting within the water layer itself. Molecular dynamics simulations of iron-oxide (hematite) particles show that water ordering around the particle decreases with decreasing particle size. These results show that nanophase structures formed by geochemical reactions can modify the interfacial forces present in aqueous solution near a surface. By mapping these interfacial forces, more sophisticated and accurate models can be developed to understand and

predict processes affecting contaminant immobilization and bacterial attachment on mineral surfaces under natural conditions.

- *Sub-nanometer catalysts are remarkably effective.* Heterogeneous catalysts are central to the conversion of natural resources into about 80% of all chemicals used by humankind. The scarcer and more expensive resources demand attainment of ever higher selectivity and energy efficiency in chemical catalysis, which imposes strict requirements for the control of catalyst structure. A new frontier has recently been achieved through the synthesis of sub-nanometer metal particles (clusters) containing only a few atoms that maintain their size throughout the stages of a chemical reaction, which is critical to attaining high activity and selectivity. Cluster size stability was achieved through delicate control over the structure of and reaction with the catalyst support, typically a mixed metal oxide. Clusters containing only 8–10 atoms of platinum bound to aluminum oxide films display 40–100 times higher catalytic activity and thousands time more chemical selectivity than conventional catalysts. Achieving this feat required synergistic efforts in the synthesis of atomically-layered, ordered oxides, leaving reaction sites open to bind certain metal clusters; soft landing and reaction of metal clusters of the selected size; synchrotron x-ray diagnostics to demonstrate cluster stability; and quantum chemical calculations for the prediction of catalytic activity as a function of cluster size.
- *New promise for plastic solar cells.* Plastic solar cells hold great promise for the conversion of solar energy into electricity because they are flexible, lightweight, inexpensive, and made from abundant organic materials. But current plastic solar cells have poor conversion efficiencies. New research on the polymers in plastic solar cells has revealed that the speed of electron transport and excitation diffusion through the polymer is much faster than was previously assumed. The new experiments used pulsed radiolysis to place electrons at the end of polymer chain tens of nanometers in length and then monitored the time it took for the electron or excitation to fall into a trap at the end of the chain. The results showed that electrons and optical excitations created in the polymers can wend their way through the chains in a matter of 10^{-10} seconds. Current, low-efficiency plastic solar cells are designed and engineered with the assumption that this transport of charge and energy down the polymer is intrinsically much slower. The discovery of more rapid transport paves the way toward more efficient plastic solar cells.
- *Nature's most efficient light harvesting system revealed.* Certain photosynthetic bacteria have evolved a sophisticated antenna complex, called the chlorosome, which allows them to thrive in an extremely light-limited environment. Unlike other natural antenna systems, chlorosomes lack a protein matrix supporting the photosynthetic pigments of up to 250,000 individual chlorophyll molecules. Structural analysis shows that the chlorophyll molecules inside the chlorosome are arranged as densely packed nanotubes in helical spirals. A recent study of the antenna protein that transfers energy absorbed by the chlorosome to the main photosynthetic reaction center determined that the protein is oriented so that the side containing the pigment with the lowest potential energy is nearest to the reaction center, consistent with theoretical predictions. These studies have begun to reveal how chlorophyll organization and chlorosome structure can increase the efficiency of photosynthesis. The relatively simple interactions between chlorophylls in the chlorosome provide promising new leads for the rational design of artificial photosynthetic systems. Similarly, the increased understanding of how energy transfer occurs through the relay protein from the antenna to the reaction centers may lead to new approaches for funneling energy through artificial photosynthetic systems.

Detailed Program Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Chemical Sciences, Geosciences, and Energy Biosciences Research	**281,946**	**288,978**	**393,131**
▪ **Atomic, Molecular, and Optical Science**	**25,129**	**22,717**	**26,118**

This activity supports theory and experiments to understand structural and dynamical properties of atoms, molecules, and nanostructures. The research emphasizes the fundamental interactions of these systems with photons and electrons to characterize and control their behavior. These efforts aim to develop accurate quantum mechanical descriptions of properties and dynamical processes of atoms, molecules, and nanoscale matter. The study of energy transfer within isolated molecules provides the foundation for understanding chemical reactivity, i.e., the process of energy transfer to ultimately make and break chemical bonds. Topics include the development and application of novel, ultrafast optical probes of matter, particularly x-ray sources; the interactions of atoms and molecules with intense electromagnetic fields; and studies of collisions and many-body cooperative interactions of atomic and molecular systems, including ultracold atomic and molecular gases. Capital equipment funding is provided for items such as lasers and optical equipment, unique ion sources or traps, position-sensitive and solid-state detectors, control and data processing electronics, and computational resources.

The knowledge and techniques produced by this activity form a science base that underpins several aspects of the DOE mission. New methods for using photons, electrons, and ions to probe matter lead to more effective use of BES synchrotron, nanoscience, and microcharacterization facilities. Similarly, the study of formation and evolution of energized states in atoms, molecules, and nanostructures provides a fundamental basis for understanding elementary processes in solar energy conversion and radiation-induced chemistry.

In FY 2011, there is an increase for the development and application of new ultrafast x-ray and optical probes of matter, including the first experiments to be performed on the Linac Coherent Light Source; on theoretical and computational methods for the interpretation of ultrafast measurements; and on the use of optical fields to control and manipulate quantum mechanical systems.

	FY 2009	FY 2010	FY 2011
▪ **Chemical Physics Research**	**47,658**	**53,509**	**75,632**

This activity supports experimental and theoretical investigations in the gas phase, in condensed phases, and at interfaces aimed at elucidating the chemical transformations and physical interactions that govern combustion; surface reactivity; and solute/solvent structure, reactivity, and transport. The gas-phase chemical physics portion emphasizes studies of the dynamics and rates of chemical reactions at energies characteristic of combustion and the chemical and physical properties of key combustion intermediates. The goal is development of validated theories and computational tools for predicting chemical reaction rates for use in combustion models and experimental tools for validating these models. Combustion models using this input are developed that incorporate complex chemistry with the turbulent flow and energy transport characteristics of real combustion processes. This activity includes support for the Combustion Research Facility (CRF), a multi-investigator research laboratory for the study of combustion science and technology that emphasizes experiment,

(dollars in thousands)

FY 2009	FY 2010	FY 2011

theory, and computation in chemical dynamics, chemical kinetics, combustion modeling, and diagnostic development.

The condensed-phase and interfacial chemical physics portion of this activity emphasizes molecular understanding of chemical, physical, and electron-driven processes in aqueous media and at interfaces. Studies of reaction dynamics at well-characterized metal or metal-oxide surfaces lead to the development of theories on the molecular origins of surface-mediated catalysis and heterogeneous chemistry. Research confronts the transition from detailed, molecular-scale understanding to cooperative and collective phenomena in complex systems. Capital equipment funding is provided for items such as lasers and optical equipment, novel position-sensitive and temporal detectors, specialized vacuum chambers for gas-phase and surface experiments, spectrometers, and computational resources.

The gas-phase portion of this activity contributes strongly to the DOE mission in the area of the efficient and clean combustion of fuels. The coupling of complex chemistry and turbulent flow has long challenged predictive combustion modeling. Truly predictive combustion models enable the design of new combustion devices (such as internal combustion engines, burners, and turbines) with maximum energy efficiency and minimal environmental consequences. In transportation, the changing composition of fuels, from those derived from light, sweet crude oil to biofuels and fuels from alternative fossil feedstocks, puts increasing emphasis on the need for science-based design of modern engines. The condensed-phase and interfacial portion of this activity impacts a variety of mission areas by providing a fundamental basis for understanding chemical reactivity in complex systems, such as those encountered in catalysis and environmental processes. Surface-mediated chemistry research in this activity complements more directed efforts in heterogeneous catalysis. Condensed-phase and interfacial chemical physics research on dissolution, solvation, nucleation, separation, and reaction provides important fundamental knowledge relevant to the environmental contaminant transport in mineral and aqueous environments. Fundamental studies of reactive processes driven by radiolysis in condensed phases and at interfaces provide improved understanding of radiolysis effects in nuclear fuel and waste environments.

In FY 2011, a significant effort will be initiated in the area of multiscale models for advanced engine design. High-fidelity models of combustion processes will be critical to enabling the transition from hardware-intensive, experience-based engine design to simulation-intensive, science-based design, accommodating new fuel types and engine combustion systems. Scientific challenges posed by advanced engine systems include complex interactions among multiphase fluid mechanics, thermodynamic properties, heat transfer, and chemical kinetics over a vast range of spatial and temporal scales. Numerical and algorithm advances will be required to develop new combustion models that exploit the capabilities of the most advanced large-scale computers. Successful resolution of these scientific and computational challenges would provide new fundamental understanding of, and models for, the conditions and fuels that will be relevant for next-generation engines (+$20,000,000). In FY 2011, there will also be increased emphasis for experimental, theoretical, and computational research aimed at developing predictive models for clean and efficient combustion of biofuels and alternative fossil fuels. Elucidating the reactivity of individual molecular sites in interfacial processes and the effects of cooperative phenomena on chemical reactivity in the condensed phase will also receive emphasis.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Solar Photochemistry	**38,385**	**36,985**	**38,453**

This activity supports molecular-level research on solar energy capture and conversion in the condensed phase and at interfaces. These investigations of solar photochemical energy conversion focus on the elementary steps of light absorption, electrical charge generation, and charge transport within a number of chemical systems, including those with significant nanostructured composition. Supported research areas include organic and inorganic photochemistry and photocatalysis, photoinduced electron and energy transfer in the condensed phase and across interfaces, photoelectrochemistry, and artificial assemblies for charge separation and transport that mimic natural photosynthetic systems. This activity, with its integration of physical and synthetic scientists devoted to solar photochemistry, is unique to DOE. Capital equipment funding is provided for items such as ultrafast laser systems, scanning tunneling microscopes, fast Fourier transform infrared and Raman spectrometers, and computational resources.

Solar photochemical energy conversion is an important option for generating electricity and chemical fuels and therefore plays a vital role in DOE's development of solar energy as a viable component of the nation's energy supply. Photoelectrochemistry provides an alternative to semiconductor photovoltaic cells for electricity generation from sunlight using closed, renewable energy cycles. Solar photocatalysis, achieved by coupling artificial photosynthetic systems for light harvesting and charge transport with the appropriate electrochemistry, provides a direct route to the generation of fuels such as hydrogen, methane, and complex hydrocarbons. Fundamental concepts derived from studying highly efficient excited-state charge separation and transport in molecular assemblies is also applicable to future molecular optoelectronic device development.

In FY 2011, continued emphasis will be placed on studies of semiconductor/polymer interfaces, multiple charge generation within semiconductor nanoparticles, dye-sensitized solar cells, inorganic/organic donor-acceptor molecular assemblies, and the use of nanoscale materials in solar photocatalytic generation of chemical fuels. This activity also includes funding for the U.S.-India Clean Energy Research Center.

	FY 2009	FY 2010	FY 2011
Photosynthetic Systems	**16,809**	**18,499**	**19,233**

This activity supports fundamental research on the biological conversion of solar energy to chemically stored forms of energy. Topics of study include light harvesting, exciton transfer, charge separation, transfer of reductant to carbon dioxide, as well as the biochemistry of carbon fixation and carbon storage. Emphasized areas are those involving strong intersection between biological sciences and energy-relevant chemical sciences and physics, such as in self-assembly of nanoscale components, efficient photon capture and charge separation, predictive design of catalysts, and self-regulating/repairing systems. Capital equipment funding is provided for items such as ultrafast lasers, high-speed detectors, spectrometers, environmentally controlled chambers, high-throughput robotic systems, and computational resources.

The impact of research in this activity is to uncover the underlying structure-function relationships and to probe dynamical processes in natural photosynthetic systems to guide the development of robust artificial and bio-hybrid systems for conversion of solar energy into electricity or chemical fuels. The ultimate goal is the development of bio-hybrid systems in which the best features from

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

nature are selectively used while the shortcomings of biology are bypassed. Achieving this goal would impact DOE's efforts to develop solar energy as an efficient, renewable energy source.

In FY 2011, research will emphasize understanding and control of the weak intermolecular forces governing molecular assembly in photosynthetic systems; understanding the biological machinery for cofactor insertion into proteins and protein subunit assemblies; adapting combinatorial, directed-evolution, and high-throughput screening methods to enhance fuel production in photosynthetic systems; characterizing the structural and mechanistic features of new photosynthetic complexes; and determining the physical and chemical rules that underlie biological mechanisms of repair and photo-protection.

	FY 2009	FY 2010	FY 2011
▪ **Physical Biosciences**	**16,148**	**17,780**	**18,486**

This activity combines experimental and computational tools from the physical sciences with biochemistry and molecular biology. A fundamental understanding of the complex processes that convert and store energy in living systems is sought. Research supported includes studies that investigate the mechanisms by which energy transduction systems are assembled and maintained, the processes that regulate energy-relevant chemical reactions within the cell, the underlying biochemical and biophysical principles determining the architecture of biopolymers and the plant cell wall, and active site protein chemistry that provides a basis for highly selective and efficient bio-inspired catalysts. Capital equipment is provided for items including advanced atomic force and optical microscopes, lasers and detectors, equipment for x-ray or neutron structure determinations, and Fourier transform infrared and nuclear magnetic resonance spectrometers.

The research provides basic structure-function information necessary to accomplish solid-phase nanoscale synthesis in a targeted manner, i.e., controlling the basic architecture of energy-transduction and storage systems. This impacts numerous DOE interests, including improved biochemical pathways for biofuel production, next generation energy conversion/storage devices, and efficient, environmentally benign, sustainable catalysts.

In FY 2011, continued emphasis will be placed on probing the organizational principles of biological energy transduction and chemical storage systems using advanced molecular imaging and x-ray or neutron methods for structural determination. Of particular interest is the molecular scale characterization of the structure and chemistry of the biopolymers of the plant cell wall, knowledge that is required for the direct catalytic conversion of biomass into chemical fuels. In FY 2011, continued emphasis will be placed on probing the organizational principles of biological energy transduction and chemical storage systems using advanced molecular imaging and x-ray or neutron methods for structural determination. Of particular interest is the molecular scale characterization of the structure and chemistry of the biopolymers of the plant cell wall, knowledge that is required for the direct catalytic conversion of biomass into chemical fuels.

	FY 2009	FY 2010	FY 2011
▪ **Catalysis Science**	**42,401**	**46,603**	**48,510**

This activity develops the fundamental scientific principles enabling rational catalyst design and chemical transformation control. Research includes the identification of the elementary steps of catalytic reaction mechanisms and their kinetics; construction of catalytic sites at the atomic level; synthesis of ligands, metal clusters, and bio-inspired reaction centers designed to tune molecular-level catalytic activity and selectivity; the study of structure-reactivity relationships of inorganic, organic, or hybrid catalytic materials in solution or supported on solids; the dynamics of catalyst structure relevant to catalyst stability; the experimental determination of potential energy landscapes for catalytic reactions; the development of novel spectroscopic techniques and structural probes for *in situ* characterization of catalytic processes; and the development of theory, modeling, and simulation of catalytic pathways. Capital equipment funding is provided for items such as ultrahigh vacuum equipment with various probes of interfacial structure, spectroscopic analytical instrumentation, and specialized cells for *in situ* synchrotron-based experiments, and computational resources.

Catalytic transformations impact an enormous range of DOE mission areas. Particular emphasis is placed on catalysis relevant to the conversion and use of fossil and renewable energy resources and the creation of advanced chemicals. Catalysts are vital in the conversion of crude petroleum and biomass into clean burning fuels and materials. They control the electrocatalytic conversion of fuels into energy in fuel cells and batteries and play important roles in the photocatalytic conversion of energy into chemicals and materials. Catalysts are crucial to creating new, energy-efficient routes for the production of basic chemical feedstocks and value-added chemicals. Environmental applications of catalytic science include minimizing unwanted products and transforming toxic chemicals into benign ones, such as the transformation of chlorofluorocarbons into environmentally acceptable refrigerants.

In FY 2011, research will focus on the chemistry of inorganic, organic, and hybrid porous materials, the nanoscale self-assembly of these systems, and the integration of functional catalytic properties into nanomaterials. New strategies for design of selective catalysts for fuel production from both fossil and renewable biomass feedstocks will be explored. Increased emphasis will be placed on the use of spectroscopy and microscopy to probe both model systems in vacuum and realistic catalytic sites. Research on catalytic cycles involved in electrochemical energy storage and solar photocatalytic fuel formation will receive increased emphasis.

	FY 2009	FY 2010	FY 2011
▪ **Separations and Analysis**	**17,150**	**15,881**	**16,511**

This activity supports fundamental research covering a broad spectrum of separation concepts, including membrane processes, extraction under both standard and supercritical conditions, adsorption, chromatography, photodissociation, and complexation. Also supported is work to improve the sensitivity, reliability, and productivity of analytical determinations and to develop new approaches to analysis in complex, heterogeneous environments, including techniques that combine chemical selectivity and spatial resolution to achieve chemical imaging. This activity is the nation's most significant long-term investment in the fundamental science underpinning actinide separations and mass spectrometry. The overall goal is to obtain a thorough understanding, at molecular and nanoscale dimensions, of the basic chemical and physical principles involved in separations systems and analytical tools so that their full utility can be realized. Capital equipment funding is provided for items such as lasers for use in sample ionization and chemical imaging, advanced mass spectrometers with nanoprobes, confocal microscopes for sub-diffraction limit resolution, and computational resources.

Work is closely coupled to DOE's stewardship responsibility for transuranic chemistry; therefore, separation and analysis of transuranic isotopes and their radioactive decay products are important components of the portfolio. Knowledge of molecular-level processes is required to characterize and treat extremely complex radioactive mixtures in, for example, new nuclear fuel systems, and to understand and predict the fate of radioactive contaminants in the environment. Separations are essential to nearly all operations in processing industries and are also necessary for many analytical procedures.

In FY 2011, separations research will focus on fluid flow in nanoscale membranes and the formation of macroscopic separation systems via self-assembly of nanoscale building blocks. Special additional emphasis will be placed on the development of new materials and methods for separation and capture of CO_2 from post-combustion gas streams and oxygen from air prior to oxy-combustion. Research will include experimental and theoretical/computational studies of how weak intermolecular forces can be understood and controlled to achieve separations with high selectivity and capture with only modest energy requirements for subsequent release. Chemical analysis research will emphasize the development of techniques with high spatial, temporal, and chemical resolution; and simultaneous application of multiple analytical techniques.

	FY 2009	FY 2010	FY 2011
▪ **Heavy Element Chemistry**	**11,033**	**11,729**	**12,195**

This activity supports research in the chemistry of the heavy elements, including actinides and fission products. The unique molecular bonding of the heavy elements is explored using theory and experiment to elucidate electronic and molecular structures, bond strengths, and chemical reaction rates. Additional emphasis is placed on the chemical and physical properties of actinides to determine solution, interfacial, and solid-state bonding and reactivity; on determining chemical properties of the heaviest actinide and transactinide elements; and on bonding relationships among the actinides, lanthanides, and transition metals. Capital equipment funding is provided for items such as instruments used to characterize actinide materials (spectrometers, diffractometers, etc.) and equipment to handle the actinides safely in laboratories and at synchrotron light sources.

This activity represents the nation's only funding for basic research in actinide and fission product chemistry and is broadly relevant to the DOE mission. Knowledge of the chemical characteristics of actinide and fission-product materials under realistic conditions provides a basis for advanced fission fuel cycles. Fundamental understanding of the chemistry of these long-lived radioactive species is required to accurately predict and mitigate their transport and fate in environments associated with the storage of radioactive wastes.

In FY 2011, continued emphasis will be placed on bonding and reactivity studies in solutions, solids, nanoparticles, and interfaces, incorporating theory and modeling to understand, predict, and control the chemical bonding and reactivity of the heavy elements, especially under extreme conditions of temperature and radiation fields to be found in advanced nuclear energy systems. Increased study of organo-actinide chemistry may provide new insights into metal-carbon bonds with metals that have large ion sizes, f-orbital bonding, and multiple oxidation states.

	FY 2009	FY 2010	FY 2011
▪ **Geosciences Research**	**22,028**	**22,432**	**50,839**

This activity supports basic experimental and theoretical research in geochemistry and geophysics. Geochemical research emphasizes fundamental understanding of geochemical processes and reaction rates, focusing on aqueous solution chemistry, mineral-fluid interactions, and isotopic distributions and migration in natural systems. Geophysical research focuses on new approaches to understand the subsurface physical properties of fluids, rocks, and minerals and develops techniques for determining such properties at a distance; it seeks fundamental understanding of wave propagation physics in complex media and the fluid dynamics of complex fluids through porous and fractured subsurface rock units. Application of x-ray and neutron scattering using BES facilities plays a key role in the geochemical and geophysical studies within this activity. The activity also emphasizes incorporating physical and chemical understanding of geological processes into multiscale computational modeling. Capital equipment funding is provided for items such as x-ray and neutron scattering end stations at BES facilities for environmental samples and for augmenting experimental, field, and computational capabilities.

This activity provides the basic research in geosciences that underpins the nation's strategy for understanding and mitigating the terrestrial impacts of energy technologies and thus is relevant to the DOE mission in several ways. It develops the fundamental understanding of geological processes relevant to geological disposal options for byproducts from multiple energy technologies. Knowledge of subsurface geochemical processes is essential to determining the fate and transport properties of harmful elements from possible nuclear or other waste releases. Geophysical imaging methods are needed to measure and monitor subsurface reservoirs for hydrocarbon production or for carbon dioxide storage resulting from large-scale carbon sequestration schemes.

In FY 2011, new research will be initiated in theory, multi-scale modeling, and field/experimental investigations of the geochemistry and geophysics of CO_2—rock/mineral interactions and other related topics (+$5,000,000). Additional research will support high-resolution geophysical and geochemical investigations. The objective will be to develop robust, broadly applicable measurement approaches to verify the effectiveness of CO_2 sequestration and other geological greenhouse gas mitigation measures. Specific emphasis will be on physical and chemical approaches for measuring properties and concentrations of chemical species in large-scale systems. The research will produce new tools and techniques that derive from longstanding BES capabilities in optical and physico-chemical diagnostics related to geosciences (+$5,000,000). In FY 2011 emphasis will also be placed on geochemical studies and computational analysis of complex subsurface fluids and solids, including nanophases; understanding the dynamics of fluid flow, particulate transport and associated rock deformation in the deep subsurface; and developing the ability to integrate multiple data types in predictions of subsurface processes and properties.

In FY 2011, Basic Energy Sciences will initiate a new research program in gas hydrates (+$17,517,000). Gas hydrates are naturally occurring combinations of methane and water that form at low temperatures and high pressure. This program will study fundamental scientific questions surrounding methane hydrates: How do they form? What is their role in the global carbon cycle? What is their role in seafloor ecological systems? How extensive are they? How stable are they? For the next 24 months, the program will also study hydrates via controlled *in situ* depressurization and physical, thermal, and chemical stimulation in the Arctic with supporting laboratory and numerical modeling to enable interpretation and extrapolation of results. Existing core sample data from the Arctic hydrate formations will provide the scientific information of how the hydrate structure sits in the pore space at various depths. The planned tests in the Gulf of Mexico in FY 2011 will take *in situ* core samples at various depths and locations for evaluation. Computer simulations will be compared with data from previous *in situ* tests. This activity will also support theory, multi-scale modeling and

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

simulation, and experimental research in areas such as the intermolecular forces that govern the structure and properties of gas hydrates and studies of gas hydrates in the natural environment.

- **Energy Frontier Research Centers (EFRCs)**[a]	**42,000**	**42,000**	**62,000**

The 46 EFRCs established in late FY 2009 are multi-investigator and multi-disciplinary centers that foster, encourage, and accelerate basic research to provide the basis for transformative energy technologies of the future.[b] The EFRCs represent an important new research modality for BES, bringing together the skills and talents of a critical mass of investigators to enable energy relevant, basic research of a scope and complexity that would not be possible with the standard single-investigator or small-group award. The scope and unique nature of the EFRC program requires special oversight, which is accomplished through a BES-wide, dedicated EFRC management team. This team has the direct management responsibility over all EFRCs and also coordinates EFRC research with the complementary research conducted within the BES core research areas.

This activity supports those EFRCs that are best coordinated with and most suitably complement the ongoing core research activities within the Chemical Sciences, Geosciences and Energy Biosciences subprogram. In general terms, these EFRCs are focused on the design, discovery, synthesis, and characterization of novel, solid-state materials that improve the conversion of solar energy and heat into electricity; that improve the conversion of electricity to light; that can be used to improve electrical energy storage; that are resistant to corrosion, decay, or failure in extreme conditions of temperature, pressure, radiation, or chemical exposures; that take advantage of emergent phenomena, such as superconductivity, to improve energy transmission; that optimize energy flow to improve energy efficiency; and that are tailored at the atomic level for catalytic activity.

In FY 2011, new EFRCs will be solicited in two categories: discovery and development of new materials that are critical to both science frontiers and technology innovations and basic research for energy needs in a limited number of areas that are underrepresented in the 46 original EFRC awards.

For the discovery and development of new materials, the emphasis will be on new synthesis capabilities, particularly bio-inspired approaches, to establish a strong foundation for science-driven materials discovery and synthesis in the U.S. Emphasis will be placed on understanding the mechanisms by which biological systems manipulate and exchange energy and information on the nanoscale. Such information can then be used as the basis for the design and synthesis of purely artificial or bio-hybrid materials with functionalities that rival their biological counterparts. One critical application area is the development of bio-inspired catalytic materials. Lessons learned from biological catalysts, including their ability to fine tune catalytic function based on subtle, dynamic changes in the structural and electronic properties of the catalytic site, will be used to design and synthesize purely artificial or bio-hybrid catalytic materials.

For research for energy applications, areas of emphasis include fundamental science of carbon capture, including the rational design of novel materials and separation processes for post-combustion CO_2 capture and catalysis and separation research for advanced carbon capture schemes

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[a] A complimentary set of EFRCs is also included in the Materials Sciences and Engineering subprogram. This set includes ongoing EFRCs as well as new awards to be initiated in FY 2011.

[b] 16 of the 46 EFRCs were forward funded for the five-year initial award period under the American Recovery and Reinvestment Act of 2009.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

in new power plants, and fundamental science for advanced nuclear energy systems, e.g., separation science and heavy element chemistry for fuel cycles. Advances in post-combustion CO_2 capture require experimental and theoretical/computational studies of how weak intermolecular forces can be understood and controlled to enable the design of capture materials and methods that are highly selective to CO_2 versus nitrogen but that release the captured CO_2 with minimum energy penalty. Carbon capture schemes for new power plants require research into efficient and cheaper ways of separating oxygen from air for oxy-combustion and new catalytic routes for the conversion of fossil feedstocks and biomass into cleaner burning fuels. Fundamental science for advanced nuclear fuel cycles includes bonding and reactivity studies in solutions, solids, nanoparticles, and interfaces, incorporating theory and modeling to understand, predict, and control the chemical bonding and reactivity of the heavy elements, especially under extreme conditions of temperature and radiation fields. Complementary emphasis will be placed on the separation and analysis of molecular species containing transuranic isotopes and their radioactive decay products, which is required to characterize and treat extremely complex radioactive mixtures in new nuclear fuel systems.

	FY 2009	FY 2010	FY 2011
▪ **Energy Innovation Hub—Fuels from Sunlight**	**0**	**0**	**24,300**

After nearly 3 billion years of evolution, nature can effectively convert sunlight into energy-rich chemical fuels using the abundant feedstocks of water and carbon dioxide. All fuels used today to power vehicles and create electricity, whether from fossil or biomass resources, are ultimately derived from photosynthesis. While biofuels are renewable resources that avoid the environmental consequences of burning the sequestered carbon of fossil fuels, their scalability and sustainability are ongoing issues. Furthermore, the overall energy efficiency of converting sunlight to plant material and then converting biomass into fuels is low. The natural photosynthetic apparatus is a remarkable machine, but plants and photosynthetic microbes were not designed to meet human energy needs—much of the energy captured from the sun is necessarily devoted to the life processes of the plants. Imagine the potential energy benefits if we could generate fuels directly from sunlight, carbon dioxide, and water in a manner analogous to the natural system, but without the need to maintain life processes. The impact of replacing fossil fuels with fuels generated directly by sunlight would be immediate and revolutionary. Recognizing this, the BESAC report, *New Science for Secure and Sustainable Energy Future*, the production of fuels directly from sunlight as one its three strategic goals for which transformational science breakthroughs are urgently needed.

Basic research has already provided enormous advances in our understanding of the subtle and complex photochemistry associated with the natural photosynthetic system. Similar advances have occurred using inorganic photo-catalytic methods to split water or reduce carbon dioxide. Yet, we still lack sufficient knowledge to design solar fuel generation systems with the required efficiency, scalability, and sustainability for economic viability. The Fuels from Sunlight Hub will develop an effective solar energy to chemical fuel conversion system. The system should operate at an overall efficiency and produce fuel of sufficient energy content to enable transition from bench-top discovery to proof-of-concept prototyping. The magnitude of this challenge is daunting, but not insurmountable, and will require that this Hub draw expertise and premier scientific talent from the disciplines of chemistry, physics, materials sciences, biology, and engineering. Critical issues to be addressed include: understanding and designing catalytic complexes or solids that generate

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

chemical fuel from carbon dioxide and/or water; integration of all essential elements from light capture to fuel formation into an effective solar fuel generation system; and pragmatic evaluation of the solar fuel system under development.

The Fuels from Sunlight Hub was initiated in FY 2010 with $22,000,000 provided through the Office of Energy Efficiency and Renewable Energy. SC/BES provides programmatic oversight for the Fuels from Sunlight Hub, including management of the solicitation and its merit review process, and coordination with the two other Energy Innovation Hubs initiated in FY 2010 – Modeling and Simulation for Nuclear Reactors in the Office of Nuclear Energy and Energy Efficient Building Systems Design in the Office of Energy Efficiency and Renewable Energy. In FY 2011, BES will provide funding for the continuation of the Fuels from Sunlight Hub.

	FY 2009	FY 2010	FY 2011
▪ **General Plant Projects (GPP)**	**3,205**	**843**	**854**

GPP funding is provided for minor new construction, for other capital alterations and additions, and for improvements to land, buildings, and utility systems principally at the Ames Laboratory and the Combustion Research Facility at Sandia National Laboratories. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and in meeting requirements for safe and reliable facilities operation. Additional GPP funding is included in the Materials Sciences and Engineering subprogram and the Scientific User Facilities subprogram. The total estimated cost of each GPP project will not exceed $5,000,000 in FY 2011.

In FY 2009, non-programmatic GPP funding for ORNL and ANL was transferred to the Science Laboratories Infrastructure program to support the SC Infrastructure Modernization Initiative.

	FY 2009	FY 2010	FY 2011
SBIR/STTR	**0**	**7,956**	**10,485**

In FY 2009, $6,736,000 and $808,000 were transferred to the SBIR and STTR programs, respectively. The FY 2010 and FY 2011 amounts shown are the estimated requirements for the continuation of the congressionally mandated SBIR and STTR programs.

	FY 2009	FY 2010	FY 2011
Total, Chemical Sciences, Geosciences, and Energy Biosciences	**281,946**	**296,934**	**403,616**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Chemical Sciences, Geosciences, and Biosciences Research	
▪ **Atomic, Molecular and Optical Science**	
Increased funding is provided for the development and application of new ultrafast x-ray and optical probes of matter (+$2,500,000), and on theoretical and computation methods for interpretation of ultrafast measurements and on the use of optical fields to control and manipulate quantum mechanical systems (+$901,000).	+3,401

	FY 2011 vs. FY 2010 ($000)
▪ **Chemical Physics Research** Increased funding is provided to initiate a significant effort in the area of multiscale models for advanced engine design (+$20,000,000). Increased funding is also provided for additional emphasis on experimental, theoretical, and computational research aimed at developing predictive models for clean and efficient combustion of biofuels and alternative fossil fuels (+$2,123,000).	+22,123
▪ **Solar Photochemistry** Increased funding is provided for research on inorganic/organic donor-acceptor molecular assemblies and in the use of nanoscale materials in solar photocatalytic generation of chemical fuels.	+1,468
▪ **Photosynthetic Systems** Increased funding is provided for solar energy conversion in biological and bio-hybrid systems and enhanced efforts in understanding defect tolerance and self-repair in natural photosynthetic systems.	+734
▪ **Physical Biosciences** Increased funding is provided for probing the organizational principles of biological energy transduction and chemical storage systems using advanced molecular imagining and x-ray or neutron methods for structural determination.	+706
▪ **Catalysis Science** Increased funding is provided for focus on the chemistry of inorganic, organic, and hybrid porous materials, the nanoscale self-assembly of these systems, and the integration of functional catalytic properties into nanomaterials.	+1,907
▪ **Separations and Analysis** Increased funding is provided for advanced chemical separations, particularly separation techniques relevant to capture of carbon dioxide and for analytical chemical imaging.	+630
▪ **Heavy Element Chemistry** Increased funding is provided for enhanced efforts on actinide chemistry and separations science related to advanced nuclear energy systems.	+466
▪ **Geosciences Research** Increased funding is provided for new research to improve understanding of the chemistry and physics of potential geophysical controls that could be used to modify effects induced by greenhouse gases (+$5,000,000) and for additional research to support high-resolution geophysical and geochemical investigations (+$5,000,000). Increased funding is also provided for continuing research in solid earth geophysics and geochemistry ($+890,000). In addition, funding is provided for the new gas hydrates research program (+$17,517,000).	+28,407

	FY 2011 vs. FY 2010 ($000)
▪ **Energy Frontier Research Centers**	
Increased funding is provided for research in discovery and development of new materials and energy related research topics.	+20,000
▪ **Energy Innovation Hub—Fuels from Sunlight**	
Funds are provided for an Energy innovation Hub focused on making fuels from sunlight. The Hub will develop a solar fuel conversion system that completely bypasses plants as the medium, drawing from the disciplines of chemistry physics, materials sciences, biology, and engineering.	+24,300
▪ **General Plant Projects (GPP)**	
Small increase for general plant projects.	+11
Total, Chemical Sciences, Geosciences and Energy Biosciences Research	**+104,153**
SBIR/STTR	
Increased funding for SBIR/STTR because of increase in operating expenses.	+2,529
Total Funding Change, Chemical Sciences, Geosciences, and Energy Biosciences	**+106,682**

Scientific User Facilities

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Scientific User Facilities			
Research	0	32,525	27,339
Major Items of Equipment	0	25,000	22,400
Facilities Operations	0	730,621	775,823
Other Project Costs	0	13,500	1,500
SBIR/STTR	0	20,038	20,059
Total, Scientific User Facilities	0[a]	821,684	847,121

Description

This subprogram supports the R&D, planning, and operation of scientific user facilities for the development of novel nano-materials and for materials characterization through x-ray, neutron, and electron beam scattering; the former is accomplished through five Nanoscale Science Research Centers and the latter is accomplished through the world's largest suite of synchrotron radiation light source facilities, neutron scattering facilities, and electron-beam microcharacterization centers.

The BES-supported suite of facilities and research centers provides a unique set of analytical tools for studying the atomic structure and functions of complex materials. These facilities provide key capabilities to correlate the microscopic structure of materials with their macroscopic properties. The synchrotron light sources, producing photons largely over a very wide range of photon energies (from the infrared to hard x-rays), shed light on fundamental aspects of the physical world, investigating energy, momentum, and position using the techniques of spectroscopy, scattering, and imaging applied over various time scales. Neutron sources take advantage of the electrical neutrality and special magnetic properties of the neutron to probe atoms and molecules and their assembly into materials. Electron beam instruments provide the spatial resolution needed to observe individual nanostructures and even single atoms by exploiting the strong interactions of electrons with matter and the ability to readily focus beams of charged particles. The Nanoscale Science Research Centers provide the ability to fabricate complex nanostructures using chemical, biological, and other synthesis techniques, and to characterize, assemble, and integrate them into devices.

Annually, the BES user facilities are visited by more than 10,000 scientists and engineers in many fields of science and technology. These facilities provide unique capabilities to the scientific community and are a critical component of maintaining U.S. leadership in the physical sciences. The light sources are an outstanding example of serving users from a diverse range of disciplines, including physical and life sciences. For example, the life sciences sector of the light sources users increased from less than 10% in the 1990s to over 40% in 2009. Also supported are research activities leading to the improvement of today's facilities and better detectors, paving the foundation for the development of next generation facilities.

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[a] FY 2009 funding of $771,198,000 for Scientific User Facilities is located within the Materials Sciences and Engineering subprogram.

Selected FY 2009 Accomplishments

- *Advanced Photon Source Develops Non-Destructive Tool for Tomography.* The research technique known as synchrotron-radiation computed laminography (SRCL) has been developed at the Advanced Photon Source for surface tomography characterization. The SRCL overcomes the limitation of standard synchrotron-radiation computed tomography, which restricts the lateral dimension of an object to be studied or requires that a sample be cut from the subject. It allows high-resolution, non-destructive three-dimensional imaging of objects, such as imaging fossil specimens for paleontological studies. Due to the complex geological and environmental processes involved, many fossils exhibit laterally-extended structures. Traditionally, this type of fossil is sectioned and imaged utilizing scanning electron microscopy or visible-light microscopes. The specimens are, however, unavoidably destroyed after inspection. The successful application of this technique opens the door to the non-destructive study of laterally-extended fossils. SRCL also finds application in imaging dimensionally long objects, including printed circuit boards, a wide range of microelectronics, and the efficacy of industrial welds and solders.
- *Top-off Operation at Advanced Light Source Achieves High Current and Stable Beam.* The Advanced Light Source has recently completed a successful upgrade, making top-off operation available to user service. The top-off operational mode allows frequent injection of electron beam into the storage ring, resulting in an almost constant current while keeping the beam accessible to users at all times. This mode presents several important advantages for users. Instead of having multiple injections of a large number of electrons in a short time period followed by uninterrupted beam decay over the course of 8 hours, a small number of electrons are added to the storage ring approximately every 30–60 seconds. The near-constant beam current enhances the flux and brightness of the radiation while simultaneously improving the thermal stability of the machine and its beamlines. Compared with pre-top-off operation, top-off mode achieves a current level of 500 mA, which doubles the time-averaged current and increases the photon flux by a factor of two.
- *Nanoparticle Research at Molecular Foundry Yields Promising Results for Energy Applications.* Researchers at the Molecular Foundry have produced for the first time non-toxic magnesium oxide nanocrystals that efficiently emit blue light and could also play a role in long-term storage of carbon dioxide, a potential means of tempering the effects of global warming. This bright blue luminescence upon exposure to ultraviolet light could be an inexpensive, attractive alternative in applications such as bio-imaging or solid-state lighting. Efficient blue light emitters are difficult to produce, suggesting these magnesium oxide nanocrystals could be a bright candidate for lighting that consumes less energy and has a longer lifespan. Along with their promising optical behavior, these nanocrystals will allow researchers to probe a key pathway in carbon dioxide capture and storage. If properly stored, captured carbon dioxide pumped underground forms carbonate minerals with the surrounding rock by reacting with nanoparticles of magnesium oxide and other mineral oxides; these nanocrystals will provide a model system to mimic this process.
- *New Technique Developed at Center for Functional Nanomaterials (CFN) for Nanostructure Fabrication.* The unique phenomena that emerge when nanoscale objects, such as gold nanoparticles or quantum dots, are arranged in small clusters offer great opportunities for energy-related applications. Unfortunately, conventional solution-based reaction methods are quite limited and inefficient, e.g., producing clusters with a broad distribution of sizes and compositions. CFN researchers have developed a novel method for producing dimmers of DNA-encoded nanoparticles with remarkably high yields. The method, which incorporates two different DNA strands on a single nanoparticle, was employed to assemble both homogenous (gold-gold) and heterogeneous (gold-

silver) nanoparticle dimmers with novel nanoscale optical properties. Because this method is scalable to large quantities with more complex cluster arrangements, it may become a practical way of inexpensively fabricating predictable and reliable nanostructures with customized properties.

- *Spallation Neutron Source Set Another World Record.* On July 11, 2009, SNS researchers set a new world record by creating 155 trillion protons in a single pulse and delivering that pulse to the SNS mercury target. This test exceeds the SNS design intensity of 150 trillion protons in a pulse. If pulses of this intensity were delivered to the SNS target at the design repetition rate of 60 pulses per second, it would provide a beam power of 1.5 megawatts—0.1 megawatts more than the design beam power of 1.4 megawatts. The SNS facility has already been operated at close to the megawatt level. The test, performed at a rate of less than one pulse per second, confirms that the SNS linear accelerator and accumulator ring—two vital components that supply the proton beam pulses—will meet and exceed the 1.4 megawatt design criteria.
- *New Technique Developed at Electron Microscopy Center.* Magnetic structure in discrete particles and complex assemblages is important in a variety of fields, particularly information storage technologies. A new approach to characterize such structures has been developed, based on the energy losses of high-energy electrons when they traverse a material and interact with spin-charge structures. The technique, electron magnetic linear dichroism, has been demonstrated by mapping the temperature and angular dependence of the signal in hematite, a form of iron oxide. The approach complements similar linear dichroism approaches that have been developed and utilized at synchrotron x-ray facilities; data quality is comparable, and the new technique extends the spatial resolution of the information into the nanoscale.

Detailed Program Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	**0**	**32,525**	**27,339**
▪ **Electron-beam Microcharacterization**	**0**	**11,571**	**11,809**

This activity supports three electron-beam microcharacterization centers, which operate as user facilities, work to develop next-generation electron-beam instrumentation, and conduct corresponding research. These centers are the Electron Microscopy Center for Materials Research at Argonne National Laboratory (ANL), the National Center for Electron Microscopy at Lawrence Berkeley National Laboratory (LBNL), and the Shared Research Equipment program at Oak Ridge National Laboratory (ORNL). Operating funds are provided to enable expert scientific interaction and technical support and to administer a robust user program at these facilities, which are made available to all researchers with access determined via peer review of brief proposals. Capital equipment funding is provided for instruments such as scanning, transmission, and scanning transmission electron microscopes; atom probes and related field ion instruments; related surface characterization apparatus and scanning probe microscopes; and/or ancillary tools such as spectrometers, detectors, and advanced sample preparation equipment.

Electron scattering has key attributes that give such approaches unique advantages and make them complementary to x-ray and neutron beam techniques. These characteristics include strong interactions with matter (allowing the capture of meaningful signals from very small amounts of material, including single atoms under some circumstances) and the ability to readily focus the charged electron beams using electromagnetic lenses. The net result is unsurpassed spatial resolution and the ability to simultaneously get structural, chemical, and other types of information from subnanometer regions, allowing study of the fundamental mechanisms of catalysis, energy conversion, corrosion, charge transfer, magnetic behavior, and many other processes. All of these are fundamental to understanding and improving materials for energy applications and the associated physical characteristics and changes that govern performance.

In FY 2011, full user operations continue at all three of these facilities, which are routinely available to users during normal working hours. The Transmission Electron Aberration Corrected Microscope (TEAM) instrument at the National Center for Electron Microscopy at LBNL will, in addition, be available to the research community 24 hours a day. This instrument was developed as a DOE Major Item of Equipment project and completed in FY 2009. It leads the world in spatial resolution and embodies the first chromatic aberration corrector in an instrument of this kind, and thus its availability opens new frontiers in imaging of materials on the nanoscale for the broad scientific community. Further research and technique development proceeds using this and other instruments at the Electron Beam Microcharacterization Centers on high-resolution imaging, atomic scale tomography, *in situ* experimentation within electron microscopes, strain and segregation in individual nanostructures, and many other related topics.

In FY 2009, $11,313,000 was provided for this activity in the Materials Sciences and Engineering Research Subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Accelerator and Detector Research**	**0**	**13,061**	**15,530**

This activity supports basic research in accelerator physics and x-ray and neutron detectors. Accelerator research is the corner stone for the development of new technologies that will improve performance of light sources and neutron spallation facilities. This research will explore new areas of science and technologies that will facilitate the construction of next generation accelerator-based user facilities. Detector research is a crucial, but often overlooked, component in the optimal utilization of user facilities. This research program is investing aggressively in research leading to a new and more efficient generation of photon and neutron detectors. Research includes studies on creating, manipulating, transporting, and diagnosing ultra-high brightness beam behavior from its origin at a photocathode to its travel through undulators. Studies on achieving sub-femtosecond (hundreds of attoseconds) free electron laser (FEL) pulses will also be underway. Demonstration experiments will take place in advanced FEL seeding techniques, such as echo-enhanced harmonic generation and other optical manipulation to reduce the cost and complexity of seeding harmonic generation FELs. A very high frequency laser photocathode radio frequency (RF) gun using a room temperature cavity will be developed which can influence the design of linac-based FELs with megahertz rates. Research will also occur on construction and beam testing of a high current, high gradient compact superconducting linac which can serve as a prototype for future light sources. Studies will continue on collective electron effects, such as micro-bunch instabilities from coherent synchrotron and edge radiation; beam bunching techniques, such as magnetic compression or velocity bunching; fast instruments to determine the structure of femtosecond electron bunches; and detectors capable of acquiring x-ray and neutron scattering data at very high collection rates.

This activity interacts with BES scientific research that employs synchrotron and neutron sources. It also coordinates with other DOE offices, especially in the funding of capabilities whose cost and

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

complexity require shared support. Research at the Accelerator Test Facility at Brookhaven National Laboratory is jointly funded by the High Energy Physics and BES programs. There is also planned collaboration with the National Science Foundation (NSF) on energy recovery linac (ERL) research. There is a coordinated effort between DOE and NSF to facilitate x-ray detector development. There are ongoing industrial interactions through the DOE Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) programs for the development of x-ray detectors and advanced accelerator technology.

Additional funds provided in FY 2011 will increase selected R&D activities related to light sources. These include the physics of gain mechanisms in FELs, rapid electron bunch diagnostics, advanced x-ray and neutron detectors, H^- high intensity sources, and accelerator modeling. These projects are essential to the efficient operation and use of present BES x-ray and neutron scattering facilities and to the design of future facilities.

In FY 2009, $9,794,000 was provided for this activity in the Materials Sciences and Engineering Research Subprogram.

	FY 2009	FY 2010	FY 2011
▪ **General Plant Projects (GPP)**	**0**	**7,893**	**0**

GPP funding is provided in FY 2010 for the ORNL Guest House. The Guest House is designed to meet the needs of the guest users coming to perform research at ORNL's world class DOE scientific user facilities (SNS, CNMS, HFIR, SHaRE, etc.). No funds are requested in FY 2011.

	FY 2009	FY 2010	FY 2011
Major Items of Equipment	**0**	**25,000**	**22,400**
▪ **Spallation Neutron Source Instrumentation I (SING I)**	**0**	**5,000**	**400**

Funds are provided to complete a Major Item of Equipment with a total estimated cost and total project cost of $68,500,000 for five instruments for the Spallation Neutron Source (SNS). The instrument concepts for the project were competitively selected using a peer review process, and the instruments are being installed at the SNS on a phased schedule between FY 2008–2011.

In FY 2009, $12,000,000 was provided for this activity in the Materials Sciences and Engineering Research Subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Spallation Neutron Source Instrumentation II (SING II)**	**0**	**18,000**	**17,000**

Funds are provided to continue a Major Item of Equipment with a total estimated cost and total project cost of $60,000,000 to fabricate four instruments to be installed at the SNS. The instrument concepts for the project have been competitively selected using a peer review process. The project is managed by Oak Ridge National Laboratory. It is anticipated that these instruments will be installed at the SNS on a phased schedule beginning in about FY 2012. The SING II instruments are in addition to the five instruments to be provided by the SING I MIE. The TPC is now approved at the Approve Performance Baseline, CD-2, for three of the four instruments. The FY 2011 request is to complete engineering design of the final instrument and to continue fabrication of the others.

In FY 2009, $7,000,000 was provided for this activity in the Materials Sciences and Engineering Research Subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **SNS Power Upgrade Project (PUP)**	**0**	**2,000**	**5,000**

Funds are provided for a Major Item of Equipment with a preliminary Total Project Cost range of $89,600,000–$96,100,000 for activities to design, build, install, and test the equipment necessary to increase the Spallation Neutron Source (SNS) proton beam energy. CD-1 was approved on January 16, 2009. In addition to the improvements in performance of instruments at the existing high power target station, this power upgrade will enable the eventual construction of a second target station. The existing facility layout and much of the existing SNS equipment was designed and built to meet the requirements of this upgrade.

The power upgrade project increases the linac beam energy from 1 GeV to 1.3 GeV. This will be accomplished by adding nine additional high beta cryomodules into the remaining nine open slots in the east end of the superconducting section of the linac. These additional cryomodule units will increase the number of high beta units from twelve to twenty one, allowing the energy to increase. The accelerator tunnel structure and cryogenic system were constructed to allow this upgrade.

FY 2010 is the first year of funding for this project. The FY 2011 request supports engineering design of the accelerator sub-systems and project management.

	FY 2009	FY 2010	FY 2011
Facilities Operations	**0**	**730,621**	**775,823**

This activity supports the operation of the BES scientific user facilities, which consist of light sources, neutron sources, nanoscience centers, and the Linac Coherent Light Source free electron laser at SLAC. These forefront research facilities require resource commitments well beyond the scope of any non-government institution and open up otherwise inaccessible facets of Nature to scientific inquiry. The BES user facilities provide open access to specialized instrumentation and expertise that enable scientific users from universities, national laboratories, and industry to carry out experiments and develop theories that could not be done at their home institutions. For approved, peer-reviewed projects, operating time is available without charge to researchers who intend to publish their results in the open literature. These large-scale user facilities—many of which were justified and built to serve a specific discipline of the physical sciences—have made significant contributions to many other fields of importance, including biology and medicine. The number of users for the synchrotron radiation sources and neutron scattering facilities are shown at the end of this subprogram description, and the number of users for all BES facilities, FY 2000–2009, is provided at http://www.sc.doe.gov/bes/users.htm. The web sites for all of the BES user facilities are available at http://www.sc.doe.gov/bes/BESfacilities.htm.

In FY 2011, operation of these scientific user facilities is funded at a level that will permit near optimal service to users. Additional funds are provided in FY 2011 for the first year of full operation of the LCLS at SLAC and for enhanced capabilities and user support at the new SNS and HFIR neutron beamlines. The light source budget increases reflect the increase in the number of operating beamlines, user support and instrumentation to upgrade beamlines at these facilities. Increases in the NSRC budgets reflect full functionality and staffing of the five NSRCs. Other project costs are provided for the National Synchrotron Light Source II at BNL. The Intense Pulsed Neutron Source is closed as a result of competing priorities, and funds are provided to begin the decommissioning of the target assembly.

In FY 2009, $689,047,000 was provided for this activity in the Materials Sciences and Engineering Research Subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

The facility operations budget request includes operating funds, capital equipment, and accelerator and reactor improvement project (AIP) funding under $5,000,000. AIP funding will support additions and modifications to accelerator and reactor facilities. General plant project (GPP) funding is also required for minor new construction, for other capital alterations and additions, and for improvements to land, buildings, and utility systems. The total estimated cost of each GPP project will not exceed $10,000,000. Capital equipment is needed to maintain optimal operation at the facilities. Items include beam monitors, interlock systems, vacuum systems, beam line front end components, optical components, and new equipment at the NSRCs. A summary of the funding for the facilities is provided below.

	FY 2009	FY 2010	FY 2011
All Facilities			
Achieved Operating Hours	30,995	N/A	N/A
Planned Operating Hours	31,800	34,000	38,000
Optimal Hours	34,000	34,000	39,000
Percent of Optimal Hours	91%	100%	97%
Unscheduled Downtime	6%	<10%	<10%
Number of Users	11,509	12,780	13,560

	FY 2009	FY 2010	FY 2011
▪ **Synchrotron Radiation Light Sources**	**0**	**366,974**	**403,613**
Advanced Light Source, LBNL	0	58,000	62,716
Advanced Photon Source, ANL	0	129,500	139,651
National Synchrotron Light Source, BNL	0	40,200	41,170
Stanford Synchrotron Radiation Light Source, SLAC	0	34,774	37,076
Linac Coherent Light Source (LCLS), SLAC	0	10,500	123,000
Linac for LCLS, SLAC	0	94,000	0

The unique properties of synchrotron radiation include its continuous spectrum, high flux and brightness, and in the case of the Linac Coherent Light Source, high coherence, which makes it an indispensable tool in the exploration of matter. The wavelengths of the emitted photons span a range of dimensions from the atom to biological cells, thereby providing incisive probes for advanced research in a wide range of areas, including materials science, physical and chemical sciences, metrology, geosciences, environmental sciences, biosciences, medical sciences, and pharmaceutical sciences.

Researchers use a variety of experimental techniques when applying synchrotron radiation to their own problems. The fundamental parameters that we use to perceive the physical world (energy, momentum, position, and time) correspond to three broad categories of synchrotron experimental measurement techniques: spectroscopy, scattering, and imaging. By exploiting the short pulse lengths of synchrotron radiation, each technique can also be performed in a timing fashion.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011 funds are provided to continue operations of the synchrotron radiation light sources. Additional funding is provided in FY 2011 for research and development associated with improvements in the Advanced Photon Source storage ring for future performance enhancement. In addition, funds are provided for research and development, leading to new and improved scattering beam lines for the 3rd generation light sources. The budget also reflects a significant increase in the beam line and accelerator operations hours as well as user support at the LCLS as it ramps up its user program in its first full year of operations. Increased funding is also provided for instrumentation to upgrade BES beamlines at the light source facilities. Capital equipment is needed at the facilities for items such as beam monitors, interlock systems, vacuum transport systems, beamline front ends, optical components and detectors.

In FY 2009, $338,755,000 was funded in the Materials Sciences and Engineering Research subprogram as follows: $55,728,000 at the Advanced Light Source, LBNL; $116,440,000 at the Advanced Photon Source, ANL; $40,154,000 at the National Synchrotron Light Source, BNL; $33,412,000 at the Stanford Synchrotron Radiation Light Source, SLAC; $3,000,000 at the Linac Coherent Light Source (LCLS), SLAC; and $90,021,000 at the Linac for LCLS, SLAC.

	FY 2009	FY 2010	FY 2011
Advanced Light Source			
Achieved Operating Hours	5,278	N/A	N/A
Planned Operating Hours	5,400	5,600	5,600
Optimal Hours	5,600	5,600	5,600
Percent of Optimal Hours	94%	100%	100%
Unscheduled Downtime	3.5%	<10%	<10%
Number of Users	1,918	2,200	2,300
Advanced Photon Source			
Achieved Operating Hours	4,883	N/A	N/A
Planned Operating Hours	4,800	5,000	5,000
Optimal Hours	5,000	5,000	5,000
Percent of Optimal Hours	98%	100%	100%
Unscheduled Downtime	2.3%	<10%	<10%
Number of Users	3,537	3,700	3,800

	FY 2009	FY 2010	FY 2011
National Synchrotron Light Source			
Achieved Operating Hours	5,499	N/A	N/A
Planned Operating Hours	5,200	5,400	5,400
Optimal Hours	5,400	5,400	5,400
Percent of Optimal Hours	102%	100%	100%
Unscheduled Downtime	2.6%	<10%	<10%
Number of Users	2,214	2,200	2,200
Stanford Synchrotron Radiation Light Source			
Achieved Operating Hours	5,050	N/A	N/A
Planned Operating Hours	5,000	5,400	5,400
Optimal Hours	5,400	5,400	5,400
Percent of Optimal Hours	94%	100%	100%
Unscheduled Downtime	1%	<10%	<10%
Number of Users	1,361	1,400	1,400
Linac Coherent Light Source			
Achieved Operating Hours	0	0	N/A
Planned Operating Hours	0	0	4,000
Optimal Hours	0	0	5,000
Percent of Optimal Hours	0	0	80%
Unscheduled Downtime	0	0	<10%
Number of Users	0	0	250

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **High-Flux Neutron Sources**	**0**	**258,980**	**262,736**
High Flux Isotope Reactor, ORNL	0	60,700	61,390
Intense Pulsed Neutron Source, ANL	0	4,000	3,000
Manuel Lujan, Jr. Neutron Scattering Center, LANL	0	11,350	11,821
Spallation Neutron Source, ORNL	0	182,930	186,525

Neutrons are a unique and effective tool for probing the structure of matter. Beams of neutrons are particularly well-suited for measurement of the positions as well as the fluctuations in the positions of atomis (phonons), and the structure (position and direction) of atomic magnetic moments in solids and the excitations in their magnetic structure (spin waves). Such studies allow physicists to take measurements leading to an understanding of phenomena such as melting, magnetic order, and superconductivity in a variety of materials.

In FY 2011 funds are provided to continue operations of the neutron sources. Additional funds are provided in FY 2011 for new operating beamlines at the Spallation Neutron Source and the High Flux Isotope Reactor at ORNL. The Intense Pulsed Neutron Source is closed and funds are provided to continue decommissioning of the target assembly.

In FY 2009, $249,802,000 was funded in the Materials Sciences and Engineering Research subprogram as follows: $58,000,000 at the High Flux Isotope Reactor, ORNL; $4,000,000 at the Intense Pulsed Neutron Source, ANL; $11,302,000 at the Manuel Lujan, Jr. Neutron Scattering Center, LANL; and $176,500,000 at the Spallation Neutron Source, ORNL.

	FY 2009	FY 2010	FY 2011
High Flux Isotope Reactor			
Achieved Operating Hours	3,892	N/A	N/A
Planned Operating Hours	3,900	4,500	4,500
Optimal Hours	4,500	4,500	4,500
Percent of Optimal Hours	86%	100%	100%
Unscheduled Downtime	0%	<10%	<10%
Number of Users	358	500	600
Manuel Lujan, Jr. Neutron Scattering Center			
Achieved Operating Hours	2,840	N/A	N/A
Planned Operating Hours	3,500	3,600	3,600
Optimal Hours	3,600	3,600	3,600
Percent of Optimal Hours	79%	100%	100%
Unscheduled Downtime	18.1%	<10%	<10%
Number of Users	416	400	400
Spallation Neutron Source			
Achieved Operating Hours	3,553	N/A	N/A
Planned Operating Hours	4,000	4,500	4,500
Optimal Hours	4,500	4,500	4,500
Percent of Optimal Hours	79%	100%	100%
Unscheduled Downtime	19.5%	<10%	<10%
Number of Users	307	700	750

	(dollars in thousands) FY 2009	FY 2010	FY 2011
▪ **Nanoscale Science Research Centers (NSRCs)**	**0**	**104,667**	**109,474**
Center for Nanophase Materials Sciences, ORNL	0	20,641	21,595
Center for Integrated Nanotechnologies, SNL/LANL	0	20,790	21,748
Molecular Foundry, LBNL	0	20,833	21,792
Center for Nanoscale Materials, ANL	0	21,570	22,547
Center for Functional Nanomaterials, BNL	0	20,833	21,792

The NSRCs are DOE's premier user centers for interdisciplinary research at the nanoscale, serving as the basis for a national program that encompasses new science, new tools, and new computing capabilities. Each center has particular expertise and capabilities in selected theme areas, such as synthesis and characterization of nanomaterials; catalysis; theory, modeling and simulation; electronic materials; nanoscale photonics; soft and biological materials; imaging and spectroscopy; and nanoscale integration. The centers are housed in recently-constructed and custom-designed laboratory buildings near one or more other major BES facilities for x-ray, neutron, or electron scattering, which complement and leverage the capabilities of the NSRCs. These laboratories contain clean rooms, nanofabrication resources, one-of-a-kind signature instruments, and other instruments not generally available except at major user facilities. These facilities are routinely made available to the research community during normal working hours. In FY 2011 funds are provided to continue operations for all five NSRCs.

In FY 2009, $100,490,000 was funded in the Materials Sciences and Engineering Research subprogram as follows: $19,900,000 at the Center for Nanophase Materials Sciences, ORNL; $19,950,000 at the Center for Integrated Nanotechnologies, SNL/LANL; $20,000,000 at the Molecular Foundry, LBNL; $20,640,000 at the Center for Nanoscale Materials, ANL; and $20,000,000 for the Center for Functional Nanomaterials, BNL.

	FY 2009	FY 2010	FY 2011
Number of Users[a]			
Center for Nanophase Materials Sciences	317	350	380
Center for Integrated Nanotechnologies	354	380	400
Molecular Foundry	209	300	350
Center for Nanoscale Materials	305	350	380
Center for Functional Nanomaterials	213	300	350

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[a] Facility operating hours are not measured at user facilities that do not rely on one central machine.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Other Project Costs	**0**	**13,500**	**1,500**
National Synchrotron Light Source-II, BNL	0	2,000	1,500
Linac Coherent Light Source (LCLS), SLAC	0	11,500	0

Other Project Costs (OPC) are associated with line-item construction or major item of equipment projects and include all project costs that are not identified in the Total Estimated Cost. Total Estimated Cost includes project costs incurred after Critical Decision-1 such as costs associated with the acquisition of land and land rights; engineering, design, and inspection; direct and indirect construction/fabrication; and the initial equipment necessary to place the plant or installation in operation. Generally, OPC are costs incurred during the project's initiation and definition phase for planning, conceptual design, research and development, and during the execution phase for research and development, startup, and operation. Other Project Costs are always operating funds.

Funds are provided in FY 2011 for other project costs associated with the National Synchrotron Light Source-II, BNL.

In FY 2009, $27,044,000 was funded in the Materials Sciences and Engineering Research subprogram as follows: $17,000,000 for the Linac Coherent Light Source, SLAC, $40,000 for the Photon Ultrafast Laser Science and Engineering Building Renovation, SLAC, $4,000 for the Advanced Light Source User Support Building, LBNL and $10,000,000 for the National Synchrotron Light Source–II, BNL.

SBIR/STTR	**0**	**20,038**	**20,059**

The FY 2010 and FY 2011 amounts shown are the estimated requirements for the continuation of the congressionally mandated SBIR and STTR programs.

Total, Scientific User Facilities	**0**	**821,684**	**847,121**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
- **Electron-beam Microcharacterization** Increase is provided for enhanced user operations within the current operating schedules of the facilities, scientific research of facility staff, and development of new instruments or techniques at the facilities.	+238
- **Accelerator and Detector Research** Increase is provided to expand the portfolio of accelerator and detector research projects, including the physics of gain mechanisms in free electron lasers (FELs), rapid electron bunch diagnostics, advanced x-ray and neutron detectors, H^- high intensity sources, and accelerator modeling.	+2,469

	FY 2011 vs. FY 2010 ($000)
▪ **General Plant Project**	
No GPP is requested in FY 2011. Funding for the ORNL Guest House project is completed in FY 2010.	-7,893
Total Research	**-5,186**
Major Items of Equipment	
▪ **Spallation Neutron Source Instrumentation I**	
Scheduled decrease for the Major Item of Equipment for the Spallation Neutron Source Instrumentation I.	-4,600
▪ **Spallation Neutron Source Instrumentation II**	
Scheduled decrease for the Major Item of Equipment for the Spallation Neutron Source Instrumentation II.	-1,000
▪ **SNS Power Upgrade Project**	
Scheduled increase for the Major Item of Equipment for the SNS Power Upgrade Project	+3,000
Total, Major Items of Equipment	**-2,600**
Facilities Operations	
▪ **Synchrotron Radiation Light Sources**	
• Increase for the Advanced Light Source to support accelerator operations and users and to provide instrumentation to upgrade BES beamlines.	+4,716
• Increase for Advanced Photon Source to support accelerator operations and users, for research and development associated with improvements in the APS storage ring for future performance enhancement, and to provide instrumentation to upgrade BES beamlines.	+10,151
• Increase for National Synchrotron Light Source to support accelerator operations and users, for research and development leading to new and improved scattering beam lines for the 3rd generation light sources, and to provide instrumentation to upgrade BES beamlines.	+970
• Increase for the Stanford Synchrotron Radiation Light Source to support accelerator operations and users and to provide instrumentation to upgrade BES beamlines.	+2,302
• Increase for the Linac Coherent Light Source to begin the first full year of operations in FY 2011.	+18,500
Total, Synchrotron Radiation Light Sources	**+36,639**

	FY 2011 vs. FY 2010 ($000)
▪ **High-Flux Neutron Sources**	
• Increase for High Flux Isotope Reactor for new operating beamlines and to support reactor operations.	+690
• Decrease for the Intense Pulsed Neutron Source to continue decommissioning of the target assembly.	-1,000
• Increase for the Manuel Lujan, Jr., Neutron Scattering Center to support target operations and users.	+471
• Increase for Spallation Neutron Source for new operating beamlines and to support operations and users.	+3,595
Total, High-Flux Neutron Sources	**+3,756**
▪ **Nanoscale Science Research Centers**	
• Increase for the Center for Nanophase Materials to support operations and users.	+954
• Increase for the Center for Integrated Nanotechnologies to support operations and users.	+958
• Increase for the Molecular Foundry to support operations and users.	+959
• Increase for the Center to Nanoscale Materials to support operations and users.	+977
• Increase for the Center for Functional Nanomaterials to support operations and users.	+959
Total, Nanoscale Science Research Centers	**+4,807**
Total, Facilities Operations	**+45,202**
Other Project Costs	
▪ Decrease for National Synchrotron Light Source-II per the project schedule.	-500
▪ Decrease for Linac Coherent Light Source per the project schedule.	-11,500
Total, Other Project Costs	**-12,000**
SBIR/STTR	
Increase in SBIR/STTR funding because of an increase in total operating expenses.	+21
Total Funding Change, Scientific User Facilities	**+25,437**

Construction

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Construction			
Advanced Light Source User Support Building, LBNL	11,500	0	0
Photon Ultrafast Laser Science and Engineering Building Renovation, SLAC	3,728	0	0
National Synchrotron Light Source-II, BNL	93,273	139,000	151,600
Linac Coherent Light Source, SLAC	36,967	15,240	0
Total, Construction	145,468	154,240	151,600

Description

Experiments in support of basic research require construction of state-of-the-art facilities and/or that existing facilities be modified to meet unique research requirements. Reactors, x-ray light sources, and pulsed neutron sources are among the expensive, but necessary, facilities used. The budget for the BES program includes funding for the construction and modification of these facilities.

The new facilities that are in design or under construction—the Linac Coherent Light Source and the National Synchrotron Light Source-II—continue the tradition of BES and SC providing the most advanced scientific user facilities for the nation's research community in the most cost effective way. All of the BES construction projects are conceived and planned with the broad user community and, during construction, are maintained on schedule and within cost. Furthermore, the construction projects all adhere to the highest standards of safety. These facilities will provide the research community with the tools to fabricate, characterize, and develop new materials and chemical processes to advance basic and applied research across the full range of scientific and technological endeavor, including chemistry, physics, earth science, materials science, environmental science, biology, and biomedical science.

Performance will be measured by meeting the cost and timetables within 10% of the baseline in the construction project data sheet.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Advanced Light Source (ALS) User Support Building, LBNL	**11,500**	**0**	**0**

The ALS User Support Building (USB) will provide high-quality user support space in sufficient quantity to accommodate the significant growth during the past decade in both the number of beamlines and the number of ALS users and to accommodate projected future expansion. The USB will provide staging areas for ALS experiments, including valuable high-bay space, wet laboratories, and temporary office space for visiting users.

The FY 2009 construction funding was used to award contract(s) as appropriate and continue the design-build construction project efforts. In addition, the project will remediate contaminated soils discovered on the project site during foundation activities. FY 2009 Recovery Act funding is used to remobilize the

(dollars in thousands)

design-build construction contractor, erect the steel, complete exterior cladding, and commence interior construction project efforts. The combination of the FY 2009 Appropriations and the Recovery Act funds fully funds this project.

	FY 2009	FY 2010	FY 2011
Photon Ultrafast Laser Science and Engineering Building Renovation, SLAC	**3,728**	**0**	**0**

Photon Ultrafast Laser Science and Engineering (PULSE) is the new center for ultrafast science at the SLAC National Accelerator Laboratory. PULSE represents a major research activity at SLAC that is a key component of the shift in the emphasis of the laboratory from high energy physics to a multi-program laboratory with significant activities in photon science. The PULSE Center is located in the Central Laboratory building (B040), a mixed use building of laboratories, offices, meeting rooms, and a library. Approximately 18,000 square feet of existing space in the two-story wing of the Central Laboratory building was renovated to meet the new PULSE programs needs for offices, laboratories, and conference rooms. FY 2009 funding was used to complete construction of PULSE.

	FY 2009	FY 2010	FY 2011
National Synchrotron Light Source-II (NSLS-II), BNL	**93,273**	**139,000**	**151,600**

The National Synchrotron Light Source-II (NSLS-II) will be a new synchrotron light source highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. It will also provide advanced insertion devices, optics, detectors, robotics, and an initial suite of scientific instruments. Together, these will enable the study of material properties and functions with a spatial resolution of about 1 nm, an energy resolution of about 0.1 meV, and the ultra-high sensitivity required to perform spectroscopy on a single molecule. The NSLS-II project will design, build, and install the accelerator hardware, experimental apparatus, civil construction, and central facilities, including offices and laboratories required to produce a new synchrotron light source. It includes a third generation storage ring, full energy injector, experimental areas, an initial suite of scientific instruments, and appropriate support equipment, all housed in a new building.

In FY 2009, construction funding was used to start the civil construction activities and progress on the NSLS-II systems components (e.g., magnet development, storage ring vacuum chambers, and radio frequency systems). In FY 2009, Recovery Act funds were used to accelerate the ring building civil construction contract activities and several major infrastructure improvements that support the NSLS-II project.

In FY 2010, construction funding will be used to continue civil construction activities and advance experimental and accelerator systems.

In FY 2011, construction funding will be used to continue civil construction activities and advance experimental and accelerator systems. Additional information is provided in the construction project data sheet 07-SC-06.

Beyond the scope of the NSLS-II construction project, an instrument development program will be implemented in the near future to address new advanced experimental techniques that will go beyond the six initial instruments funded by the project.

	FY 2009	FY 2010	FY 2011
Linac Coherent Light Source, SLAC	**36,967**	**15,240**	**0**

The Linac Coherent Light Source (LCLS) Project will provide laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak brightness than any existing coherent x-ray light

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

source. The LCLS Project will provide the first demonstration of an x-ray free electron laser (FEL) in the 1.5-15 Angstrom range and will apply these extraordinary, high-brightness x-rays to an initial set of scientific problems described below. This will be the world's first such facility. The LCLS will have properties vastly exceeding those of current x-ray sources (both synchrotron radiation light sources and so-called table-top x-ray lasers) in three key areas: peak brightness, coherence (i.e., laser-like properties), and ultrashort pulses. The peak brightness of the LCLS is 10 billion times greater than current synchrotrons, providing 10^{11} x-ray photons in a pulse with duration of less than 230 femtoseconds. These characteristics of the LCLS will open new realms of scientific application in the chemical, material, and biological sciences.

In FY 2009, funding was used for installation of undulator and photon diagnostics, experimental halls, and technical hardware for x-ray transport systems. In addition, SLAC commenced a design and initiated construction of a user office builder adjacent to the near experimental hall to provide space in support of the LCLS operations in lieu of renovating of existing older buildings at SLAC. This user building adjacent to the near experimental hall provided a more cost effective and efficient solution to addressing the user office space needs than renovating old space at various buildings in SLAC. Commissioning of the facility will also continue on a phased schedule. In FY 2010, funds will complete construction and commissioning elements of the project. FY 2011 is expected to be the first full year of LCLS facility operations.

	FY 2009	FY 2010	FY 2011
Total, Construction	**145,468**	**154,240**	**151,600**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
National Synchrotron Light Source-II (NSLS II), BNL	
Increase in funding to continue construction of the NSLS II project, as scheduled.	+12,600
Linac Coherent Light Source, SLAC	
Decrease in funding representing the completion of construction funding in FY 2010, as scheduled.	-15,240
Total Funding Change, Construction	**-2,640**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	1,256,023	1,334,500	1,492,137
Capital Equipment	100,916	100,068	151,637
General Plant Projects	11,848	13,992	2,364
Accelerator Improvement Projects	21,510	33,700	37,262
Construction	145,468	154,240	151,600
Total, Basic Energy Sciences	1,535,765	1,636,500	1,835,000

Funding Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	632,758	663,114	841,006
Scientific User Facilities Operations	689,047	730,621	775,823
Major Items of Equipment	34,000	25,000	22,400
Construction Projects (includes OPC)	172,512	167,740	153,100
Other	7,448	50,025	42,671
Total, Basic Energy Sciences	1,535,765	1,636,500	1,835,000

Scientific User Facility Operations

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Light Source User Facilities			
Advanced Light Source, LBNL	55,728	58,000	62,716
Advanced Photon Source, ANL	116,440	129,500	139,651
National Synchrotron Light Source, BNL	40,154	40,200	41,170
Stanford Synchrotron Radiation Light Source, SLAC	33,412	34,774	37,076
Linac Coherent Light Source (LCLS), SLAC	3,000	10,500	123,000
Linac for LCLS, SLAC	90,021	94,000	0
Total, Light Sources User Facilities	338,755	366,974	403,613
Neutron Source User Facilities			
High Flux Isotope Reactor, ORNL	58,000	60,700	61,390
Intense Pulsed Neutron Source, ANL	4,000	4,000	3,000

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Manuel Lujan, Jr. Neutron Scattering Center, LANL	11,302	11,350	11,821
Spallation Neutron Source, ORNL	176,500	182,930	186,525
Total, Neutron Source User Facilities	249,802	258,980	262,736
Nanoscale Science Research Center User Facilities			
Center for Nanophase Materials Sciences, ORNL	19,900	20,641	21,595
Center for Integrated Nanotechnologies, SNL/LANL	19,950	20,790	21,748
Molecular Foundry, LBNL	20,000	20,833	21,792
Center for Nanoscale Materials, ANL	20,640	21,570	22,547
Center for Functional Nanomaterials, BNL	20,000	20,833	21,792
Total, Nanoscale Science Research Center User Facilities	100,490	104,667	109,474
Total, Scientific User Facility Operations	689,047	730,621	775,823

Facilities Users and Hours

	FY 2009	FY 2010	FY 2011
Advanced Light Source			
Achieved Operating Hours	5,278	N/A	N/A
Planned Operating Hours	5,400	5,600	5,600
Optimal Hours	5,600	5,600	5,600
Percent of Optimal Hours	94%	100%	100%
Unscheduled Downtime	3.5%	<10%	<10%
Number of Users	1,918	2,200	2,300
Advanced Photon Source			
Achieved Operating Hours	4,883	N/A	N/A
Planned Operating Hours	4,800	5,000	5,000
Optimal Hours	5,000	5,000	5,000
Percent of Optimal Hours	98%	100%	100%
Unscheduled Downtime	2.3%	<10%	<10%
Number of Users	3,537	3,700	3,800

	FY 2009	FY 2010	FY 2011
National Synchrotron Light Source			
Achieved Operating Hours	5,499	N/A	N/A
Planned Operating Hours	5,200	5,400	5,400
Optimal Hours	5,400	5,400	5,400
Percent of Optimal Hours	102%	100%	100%
Unscheduled Downtime	2.6%	<10%	<10%
Number of Users	2,214	2,200	2,200
Stanford Synchrotron Radiation Light Source			
Achieved Operating Hours	5,050	N/A	N/A
Planned Operating Hours	5,000	5,400	5,400
Optimal Hours	5,400	5,400	5,400
Percent of Optimal Hours	94%	100%	100%
Unscheduled Downtime	1%	<10%	<10%
Number of Users	1,361	1,400	1,400
Linac Coherent Light Source			
Achieved Operating Hours	0	0	N/A
Planned Operating Hours	0	0	4,000
Optimal Hours	0	0	5,000
Percent of Optimal Hours	0	0	80%
Unscheduled Downtime	0	0	<10%
Number of Users	0	0	250
High Flux Isotope Reactor			
Achieved Operating Hours	3,892	N/A	N/A
Planned Operating Hours	3,900	4,500	4,500
Optimal Hours	4,500	4,500	4,500
Percent of Optimal Hours	86%	100%	100%
Unscheduled Downtime	0%	<10%	<10%
Number of Users	358	500	600

	FY 2009	FY 2010	FY 2011
Manuel Lujan, Jr. Neutron Scattering Center			
Achieved Operating Hours	2,840	N/A	N/A
Planned Operating Hours	3,500	3,600	3,600
Optimal Hours	3,600	3,600	3,600
Percent of Optimal Hours	79%	100%	100%
Unscheduled Downtime	18.1%	<10%	<10%
Number of Users	416	400	400
Spallation Neutron Source			
Achieved Operating Hours	3,553	N/A	N/A
Planned Operating Hours	4,000	4,500	4,500
Optimal Hours	4,500	4,500	4,500
Percent of Optimal Hours	79%	100%	100%
Unscheduled Downtime	19.5%	<10%	<10%
Number of Users	307	700	750
Center for Nanophase Materials Sciences[a]			
Number of Users	317	350	380
Center for Integrated Nanotechnologies[a]			
Number of Users	354	380	400
Molecular Foundry[a]			
Number of Users	209	300	350
Center for Nanoscale Materials[a]			
Number of Users	305	350	380
Center for Functional Nanomaterials[a]			
Number of Users	213	300	350

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[a] Facility operating hours are not measured at user facilities that do not rely on one central machine.

	FY 2009	FY 2010	FY 2011
Total, All Facilities			
Achieved Operating Hours	30,995	N/A	N/A
Planned Operating Hours	31,800	34,000	38,000
Optimal Hours	34,000	34,000	39,000
Percent of Optimal Hours	91%	100%	97%
Unscheduled Downtime	6%	<10%	<10%
Number of Users	11,509	12,780	13,560

Major Items of Equipment

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act Approp.	FY 2010	FY 2011	Outyears	Total
Spallation Neutron Source Instrumentation I, ORNL							
TEC/TPC	51,100	12,000	0	5,000	400	0	68,500
Spallation Neutron Source Instrumentation II, ORNL							
TEC/TPC	6,500	7,000	0	18,000	17,000	11,500	60,000
Linac Coherent Light Source Instrumentation, SLAC							
TEC	6,500	15,000	33,600	0	0	0	55,100
OPC	4,900	0	0	0	0	0	4,900
TPC	11,400	15,000	33,600	0	0	0	60,000
SNS Power Upgrade Project (01VI), ORNL							
TEC/TPC	0	0	0	2,000	5,000	89,100	96,100
Total, Major Items of Equipment							
TEC/TPC		34,000	33,600	25,000	22,400		

Construction Projects

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Additional	FY 2010	FY 2011	Outyears	Total
08-SC-01 Advanced Light Source User Support Building, LBNL							
TEC	6,454	11,500	14,546	0	0	0	32,500[a]
OPC	2,480	4	136	0	0	0	2,620
TPC	8,934	11,504	14,682	0	0	0	35,120
08-SC-11 Photon Ultrafast Laser Science and Engineering Building Renovation, SLAC							
TEC	7,332	3,728	0	0	0	0	11,060[b]
OPC	100	40	0	0	0	0	140
TPC	7,432	3,768	0	0	0	0	11,200
07-SC-06, National Synchrotron Light Source-II, BNL							
TEC	32,727	93,273	150,000	139,000	151,600	224,600	791,200
OPC	47,800	10,000	0	2,000	1,500	59,500	120,800
TPC	80,527	103,273	150,000	141,000	153,100	284,100	912,000
05-R-320 Linac Coherent Light Source, SLAC							
TEC	299,793	36,967	0	15,240	0	0	352,000[c]
OPC	39,500	17,000	0	11,500	0	0	68,000
TPC	339,293	53,967	0	26,740	0	0	420,000
Total, Construction							
TEC		145,468	164,546	154,240	151,600		
OPC		27,044	136	13,500	1,500		
TPC		172,512	164,682	167,740	153,100		

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[a] Includes $1,500,000 of PED included in the 07-SC-12 PED, LBNL Advanced Light source User Support Building data sheet.

[b] Includes $941,000 of PED included in the 08-SC-10 PED, Photon Ultrafast Laser Science and Engineering Building Renovation, SLAC data sheet.

[c] Includes $35,974,000 of PED included in the 03-SC-002 PED, SLAC, Linac Coherent Light Source data sheet.

Scientific Employment

	FY 2009 Estimate	FY 2010 Estimate	FY 2011Estimate
# of University Grants	1,180	1,210	1,400
Average Size per year	175,000	175,000	215,000
# Permanent Ph.D's (FTEs)	4,560	4,670	5,590
# Postdoctoral Associates (FTEs)	1,270	1,300	1,620
# Graduate Students (FTEs)	2,000	2,050	2,570

07-SC-06, National Synchrotron Light Source II (NSLS-II)
Brookhaven National Laboratory, Upton, New York
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-3, Start of Construction, which was approved on January 9, 2009, with a Total Project Cost (TPC) of $912,000,000. The project is approximately one year past CD-3 approval. The overall project is approximately 22.0% complete with cumulative project Cost Performance Index (CPI) and Schedule Performance Index (SPI) at the end of November 2009 at 1.04 and 0.97 respectively. Excepting the Laboratory Office Buildings (LOB), all major civil construction sub-contracts are well underway. Concrete foundations for the ring building are approximately 24% complete, and steel erection is planned to begin in February. All contracts to fabricate the storage ring magnets have been awarded. Conceptual design of the beam lines is complete and has transitioned to preliminary design.

The Federal Project Director was certified at level 3 in 2008. He is continuing Project Manager Career Development Program (PMCDP) coursework along with fulfilling experience requirements for level 4 certification. He expects to apply for level 4 certification in FY 2010.

This PDS is an update of the FY 2010 PDS.

2. Design, Construction, and D&D Schedule

	CD-0	CD-1	(Design/PED Complete)	CD-2	CD-3	CD-4
FY 2007	08/25/2005	1Q FY 2007	4Q FY 2008	TBD	TBD	TBD
FY 2008	08/25/2005	2Q FY 2007	2Q FY 2009	TBD	TBD	TBD
FY 2009	08/25/2005	07/12/2007	2Q FY 2009	2Q FY 2008	2Q FY 2009	3Q FY 2015
FY 2010	08/25/2005	07/12/2007	2Q FY 2009	01/18/2008	01/09/2009	3Q FY 2015
FY 2011	08/25/2005	07/12/2007	4Q FY 2010	01/18/2008	01/09/2009	3Q FY 2015

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approved Start of Construction
CD-4 – Approve Project Completion

	D&D Start	D&D Complete	Performance Baseline Validation
FY 2007	N/A	N/A	0
FY 2008	N/A	N/A	0
FY 2009	N/A	N/A	12/11/2007
FY 2010	N/A	N/A	12/11/2007
FY 2011	N/A	N/A	12/11/2007

D&D Start – Not Applicable to this project
D&D Complete – Not Applicable to this project

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC D&D	OPC, Total	TPC
FY 2007	75,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2008	75,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2009	60,000	731,200	791,200	120,800	0	120,800	912,000
FY 2010	60,000	731,200	791,200	120,800	0	120,800	912,000
FY 2011	60,000	731,200	791,200	120,800	0	120,800	912,000

4. Project Description, Justification, and Scope

The National Synchrotron Light Source II (NSLS-II) will be a new synchrotron light source, highly optimized to deliver ultra-high brightness and flux and exceptional beam stability. It will also provide advanced insertion devices, optics, detectors, robotics, and an initial suite of scientific instruments. Together, these will enable the study of material properties and functions with a spatial resolution of about 1 nm, an energy resolution of about 0.1 meV, and the ultra-high sensitivity required to perform spectroscopy on a single molecule.

The NSLS-II project will design, build, and install the accelerator hardware, experimental apparatus, civil construction, and central facilities including offices and laboratories required to produce a new synchrotron light source. It includes a third generation storage ring, full energy injector, experimental areas, an initial suite of scientific instruments, and appropriate support equipment, all housed in a new building.

Major advances in energy technologies will require scientific breakthroughs in developing new materials with advanced properties. A broad discussion is given in several recent reports, including the Basic Energy Sciences (BES) Advisory Committee reports entitled *Opportunities for Catalysis in the 21st Century*, *Basic Research Needs to Assure a Secure Energy Future*, *Basic Research Needs for the Hydrogen Economy*, and *Basic Research Needs for Solar Energy Utilization*, in addition to the report of the Nanoscale Science, Engineering, and Technology Subcommittee of the National Science and Technology Committee entitled *Nanoscience Research for Energy Needs*.

Collectively, these reports underscore the need to develop new tools that will allow the characterization of the atomic and electronic structure, the chemical composition, and the magnetic properties of materials with nanoscale resolution. Needed are non-destructive tools to image and characterize structures and interfaces below the surface, and these tools must operate in a wide range of temperature and harsh environments. The absence of any tool possessing these combined capabilities was identified as a key barrier to progress in the 1999 BES report *Nanoscale Science, Engineering and Technology Research Directions*.

In order to fill this capability gap, the Office of Science has determined that its mission requires a synchrotron light source that will enable the study of material properties and functions, particularly materials at the nanoscale, at a level of detail and precision never before possible. NSLS-II will provide these capabilities. Only x-ray methods have the potential of satisfying all of these requirements, but advances both in x-ray optics and in x-ray brightness and flux are required to achieve a spatial resolution of 1 nm and an energy resolution of 0.1 meV.

There are no alternative tools with a spatial resolution of 1 nm and energy resolution of 0.1 meV that also have the required capabilities of being non-destructive and able to image and characterize buried structures and interfaces in a wide range of temperatures and harsh environments. An analysis found that upgrading existing light sources was either impossible or not cost effective. In the case of NSLS-I, it was found that it would be impossible to upgrade this light source due to numerous technical difficulties, including accelerator physics and infrastructure constraints, such as its small circumference, which limit the feasible in-place upgrade options.

The key performance parameters are defined in the project execution plan. The NSLS-II project is expected to deliver an electron energy of 3.0 giga-electron volts with a stored current of 25 milliamps; build a third generation storage ring of approximately one half mile in circumference and experimental and operations facilities with a total conventional construction of approximately 400 thousand gross square feet, and include an initial suite of six beamlines ready for commissioning.

Research and development activities funded under Other Project Costs will address technical risk in several key areas including energy resolution, spatial resolution, and storage ring magnets.

Beyond the scope of the NSLS-II construction project, an instrument development program will be implemented in the near future to address new advanced experimental techniques that will go beyond the six initial instruments funded by the project.

Project Engineering and Design funds were used to complete the detailed design, including detailed estimates of construction based on the approved design, final working drawings and specifications, and schedules for construction and procurements.

FY 2009 construction funds were used to start the civil construction activities and continue progress on the NSLS-II systems components (e.g. magnet development, storage ring vacuum chambers, and radio frequency systems). American Recovery and Reinvestment Act of 2009 (Recovery Act) funds were used to accelerate the civil construction activity as well as advance some major procurements in the project timeline. FY 2010 funds will be used to continue civil construction and advance experimental and accelerator systems. FY 2011 funds will be used to continue civil construction and advance experimental and accelerator systems.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Total Estimated Cost (TEC)				
PED				
FY 2007	3,000	3,000	0	2,292
FY 2008	29,727	29,727	0	28,205
FY 2009	27,273	27,273	0	23,044
FY 2010	0	0	0	6,459
Total, PED	60,000	60,000	0	60,000

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Construction				
FY 2009	66,000	66,000	0	24,092
FY 2009 Recovery Act	150,000	150,000	14,751	0
FY 2010	139,000	139,000	114,198	49,000
FY 2011	151,600	151,600	21,051	228,934
FY 2012	151,400	151,400	0	172,343
FY 2013	46,900	46,900	0	68,137
FY 2014	26,300	26,300	0	30,230
FY 2015	0	0	0	8,464
Total, Construction	731,200	731,200	150,000	581,200
TEC				
FY 2007	3,000	3,000	0	2,292
FY 2008	29,727	29,727	0	28,205
FY 2009	93,273	93,273	0	47,136
FY 2009 Recovery Act	150,000	150,000	14,751	0
FY 2010	139,000	139,000	114,198	55,459
FY 2011	151,600	151,600	21,051	228,934
FY 2012	151,400	151,400	0	172,343
FY 2013	46,900	46,900	0	68,137
FY 2014	26,300	26,300	0	30,230
FY 2015	0	0	0	8,464
Total, TEC	791,200	791,200	150,000	641,200
Other Project Cost (OPC)				
OPC except D&D				
FY 2005	1,000	1,000	0	0
FY 2006	4,800	4,800	0	4,958
FY 2007	22,000	22,000	0	20,461
FY 2008	20,000	20,000	0	15,508
FY 2009	10,000	10,000	0	7,101
FY 2010	2,000	2,000	0	6,420
FY 2011	1,500	1,500	0	3,797
FY 2012	7,700	7,700	0	8,759
FY 2013	24,400	24,400	0	24,500
FY 2014	22,400	22,400	0	22,400
FY 2015	5,000	5,000	0	6,896
Total, OPC except D&D	120,800	120,800	0	120,800

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Total Project Cost (TPC)				
FY 2005	1,000	1,000	0	0
FY 2006	4,800	4,800	0	4,958
FY 2007	25,000	25,000	0	22,753
FY 2008	49,727	49,727	0	43,713
FY 2009	103,273	103,273	0	54,237
FY 2009 Recovery Act	150,000	150,000	14,751	0
FY 2010	141,000	141,000	114,198	61,879
FY 2011	153,100	153,100	21,051	232,731
FY 2012	159,100	159,100	0	181,102
FY 2013	71,300	71,300	0	92,637
FY 2014	48,700	48,700	0	52,630
FY 2015	5,000	5,000	0	15,360
Total, TPC	912,000	912,000	150,000	762,000

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	60,000	60,000	49,000
Contingency	0	0	11,000
Total, PED	60,000	60,000	60,000
Construction			
Site Preparation	9,243	9,243	9,243
Equipment	32,078	32,078	31,579
Other Construction	545,379	518,635	518,381
Contingency	144,500	171,244	171,997
Total, Construction	731,200	731,200	731,200
Total, TEC	791,200	791,200	791,200
Contingency, TEC	144,500	171,244	182,997

	(dollars in thousands) Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
Conceptual Planning	24,800	24,800	24,800
Research and Development	35,800	35,800	35,800
Start-Up	50,200	50,200	50,200
Contingency	10,000	10,000	10,000
Total, OPC	120,800	120,800	120,800
Contingency, OPC	10,000	10,000	10,000
Total, TPC	912,000	912,000	912,000
Total, Contingency	154,500	181,244	192,997

7. Funding Profile History

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2007[a]	TEC	75,000	0	0	0	0	0	0	0	0	75,000
	OPC	46,000	0	0	0	0	0	0	0	0	46,000
	TPC	121,000	0	0	0	0	0	0	0	0	121,000
FY 2008[a]	TEC	65,000	10,000	0	0	0	0	0	0	0	75,000
	OPC	50,800	0	0	0	0	0	0	0	0	50,800
	TPC	115,800	10,000	0	0	0	0	0	0	0	125,800
FY 2009[b]	TEC	32,727	93,273	0	162,500	252,900	166,100	57,400	26,300	0	791,200
	OPC	47,800	10,000	0	2,000	1,500	7,700	24,400	22,400	5,000	120,800
	TPC	80,527	103,273	0	164,500	254,400	173,800	81,800	48,700	5,000	912,000
FY 2010	TEC	32,727	93,273	150,000	139,000	151,600	151,400	46,900	26,300	0	791,200
	OPC	47,800	10,000	0	2,000	1,500	7,700	24,400	22,400	5,000	120,800
	TPC	80,527	103,273	150,000	141,000	153,100	159,100	71,300	48,700	5,000	912,000
FY 2011	TEC	32,727	93,273	150,000	139,000	151,600	151,400	46,900	26,300	0	791,200
	OPC	47,800	10,000	0	2,000	1,500	7,700	24,400	22,400	5,000	120,800
	TPC	80,527	103,273	150,000	141,000	153,100	159,100	71,300	48,700	5,000	912,000

8. Related Operations and Maintenance Funding Requirements

Beneficial Occupancy of the Experimental Floor	4Q FY 2012
Expected Useful Life (number of years)	25
Expected Future start of D&D of this capital asset (fiscal quarter)	N/A

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[a] The FY 2007 and FY 2008 requests were for PED funding only.

[b] FY 2009 reflects the original validated funding baseline.

(Related Funding Requirements)

(dollars in thousands)

	Annual Costs		Life cycle costs	
	Current Estimate	Prior Estimate	Current Estimate	Prior Estimate
Operations	119,400	119,400	4,470,000	4,470,000
Maintenance	21,100	21,100	789,000	789,000
Total Operations and Maintenance	140,500	140,500	5,259,000	5,259,000

9. Required D&D Information

	Square Feet
Area of new construction	Approximately 400,000
Area of existing facilities being replaced	N/A
Area of any additional space that will require D&D to meet the "one-for-one" requirement	NA (see below)

The existing facility (NSLS) will be converted to another use. The one-for-one replacement has been met through completed and planned elimination of space at Brookhaven National Laboratory (BNL) along with "banked" space at the Massachusetts Institute of Technology (MIT) in Middleton, MA, and at the East Tennessee Technology Park (ETTP) in Oak Ridge, TN. A waiver from the one-for-one requirement to eliminate excess space at Brookhaven to offset the NSLS-II project was approved by Secretary Bodman on April 20, 2007. The waiver identified approximately 460,000 square feet of banked excess facilities space that were eliminated in FY 2006 at MIT and ETTP.

10. Acquisition Approach (formerly Method of Performance)

The acquisition strategy selected relies on the BNL management and operating (M&O) contractor to directly manage the NSLS-II acquisition. The acquisition of large research facilities is within the scope of the DOE contract for the management and operation of BNL and consistent with the general expectation of the responsibilities of DOE M&O contractors.

The design, fabrication, assembly, installation, testing, and commissioning of the NSLS-II project will largely be performed by the BNL NSLS-II scientific and technical staff. Much of the subcontracted work to be performed for NSLS-II consists of hardware fabrication and conventional facilities construction. Each system or component will be procured using fixed price contracts, unless there is a compelling reason to employ another contract type. Best-value competitive procurements will be employed to the maximum extent possible.

Many major procurements will be either build-to-print, following BNL/NSLS-II drawings and specifications, or readily available off-the-shelf. Source selection will be carried out in accordance with DOE-approved policies and procedures. Acquisition strategies will be chosen to obtain the best value based on the assessment of technical and cost risks on a case-by-case basis. For standard, build-to-print fabrications and the purchase of off-the-shelf equipment for routine applications, available purchasing techniques include price competition among technically qualified suppliers and use of competitively awarded blanket purchase agreements.

The architect-engineer (A-E) contract was placed on a firm-fixed-price basis for the Final (Title II) Design and (Title III) construction support services. The general construction contract was also placed on a firm-fixed-price basis. The design specifications are sufficiently detailed to allow prospective constructors to formulate firm-fixed-price offers without excessive contingency and allowances.

NSLS-II project management has identified major procurements that represent significant complexity or cost and schedule risk. Advance procurement plans (APPs) are being prepared for each major procurement. The APPs include discussion of contract type, special contracting methods, special clauses or deviations required, and lease or purchase decisions. These final APPs will identify critical procurement activities and help to mitigate or avoid schedule conflicts and other procurement-related problems. At appropriate dollar levels, the APPs are approved by the responsible Division Director, the NSLS-II Procurement Manager, the NSLS-II Deputy Director, and the NSLS-II Project Director.

Biological and Environmental Research
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Biological and Environmental Research				
Biological Systems Science	0[b]	0	318,476	321,947
Climate and Environmental Sciences	0[b]	0	285,706	304,953
Biological Research	412,153[b]	+100,793	0	0
Climate Change Research	173,023[b]	+64,860	0	0
Total, Biological and Environmental Research	585,176[c]	+165,653	604,182	626,900

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The Biological and Environment Research (BER) program mission is to understand complex biological, climatic, and environmental systems across spatial and temporal scales ranging from sub-micron to global, from individual molecules to ecosystems, and from nanoseconds to millennia. This is accomplished by exploring the frontiers of genome-enabled biology; discovering the physical, chemical, and biological drivers of climate change; and seeking the geochemical, hydrological, and biological determinants of environmental sustainability and stewardship.

Background

The wonders of Earth, how it works, and how we can sustain it for future generations are the subject of discussion and debate from the classroom to the pages of scientific journals. We hear arguments about the threat and controversy of global warming, rising greenhouse gases, and increasing temperatures; about the promise of biofuels and concerns of whether we will be able to produce sufficient, affordable quantities in a manner that protects the environment; and about the challenge of protecting our rivers and aquifers from environmental contaminants left as a legacy of nuclear weapons development. These practical arguments and challenges are driven by a foundation of scientific knowledge and inquiry in atmospheric chemistry and physics, ecology, genetics, and subsurface science. Studies in these areas probe questions such as: What determines Earth's climate? How does a genome give life to microbes, plants, and ecosystems? What are the biological and physical forces that govern the behavior of Earth's subsurface environment? The BER program supports research addressing these questions to provide an understanding of Nature that enables DOE to discover and develop solutions to our energy and environmental challenges.

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] $313,688,000 of the FY 2009 funding for the Biological Research program is for activities funded in the Biological Systems Science subprogram in FY 2010 and FY 2011. $98,465,000 of the FY 2009 funding for the Biological Research subprogram and all of the $173,023,000 in the Climate Change Research subprogram is for activities funded in the Climate Change and Environmental Sciences subprogram in FY 2010 and FY 2011.

[c] Total is reduced by $16,364,000; $14,611,000 of which was transferred to the Small Business Innovation Research (SBIR) program; and $1,753,000 of which was transferred to the Small Business Technology Transfer (STTR) program.

BER's origins date to 1946, the atomic bomb, concerns for health effects from exposure to radiation, and the promise of benefits from peaceful uses of nuclear energy. BER-funded health effects research provided breakthroughs in genetics and developments in nuclear medicine, such as radioisotopes for common medical tests and computed tomography (CT) and positron emission tomography (PET) scanners that still benefit millions of patients each year. Interest in the effects of radiation exposure led to the pursuit of an understanding of the most fundamental level of biology, DNA, and in turn led DOE's initiation of the Human Genome Project, spearheading today's biotechnology revolution. The need to understand the global distribution of fallout from weapons tests in the 1950s and 1960s led DOE to develop the first ecological research programs to understand clouds, models to predict the behavior of particles in the atmosphere, and today, models to understand and predict future climate.

Today, the BER science portfolio includes research programs and scientific user facilities that address some of the most exciting problems in biological, climatic, and environmental research. BER research uncovers Nature's secrets from the diversity of microbes and plants to understand how biological systems work, how they interact with each other, and how they can be manipulated to harness their processes and products. By starting with an organism's DNA, BER-funded scientists seek to understand whole biological systems as the systems respond to and modify their environments. The biological systems that BER scientists investigate range from individual proteins and other molecules, to groups of molecules that comprise molecular machines, to interconnected biological networks within whole cells, communities of cells and organisms, and ecosystems.

BER plays a vital role in supporting research on atmospheric processes, climate change modeling, interactions between ecosystems and greenhouse gases (especially carbon dioxide, CO_2), and analysis of impacts of climatic change on energy production and use. Understanding the Earth's radiant energy balance is the largest uncertainty in determining the rate of global climate change. BER supports research on the factors determining that balance—the role of different types of clouds, atmospheric particles, and greenhouse gases. BER also supports research to understand the impacts of climatic change—warmer temperatures, changes in precipitation, increased levels of greenhouse gases—on different ecosystems such as forests, grasslands, and farmland. In addition, the Earth's subsurface is a new frontier for discovering novel microorganisms and understanding important geochemical and hydrological processes, including the fate of environmental contaminants.

A common theme across BER's research portfolio, is the challenge and excitement of studying complex systems. The systems studied have their own unique complexity covering remarkable spatial and temporal scales. In living systems, the scales of interest can be as small as the interactions of individual proteins or fragments of DNA within a single cell or as large as an entire organism—a microbe or a person—or even an entire forest of trees used as the starting material for producing biofuels or responding to climate change. The range of critical time scales in living systems is equally vast, ranging from fractions of a second required for the interaction of biological molecules to decades or even centuries to understand the long-term ecological impacts of a changing climate or the sustained production of specific biofuel feedstock crops for production of biofuels. A unique complexity to the study of spatial or temporal scales in living systems is the genetic capacity of those systems to directly regulate their interactions with other systems and to replicate themselves, features not found in other systems studied by the Office of Science. The ranges of scales of interest are equally complex for studies of Earth's climate and subsurface. These range from particles in a cloud or the subsurface environment to the Earth's entire atmosphere or a regional aquifer. At the temporal scale they also range from fractions of a second for interactions at the molecular level to decades or centuries to understand the long term effects of climate change or the behaviors of contaminants in the subsurface. Essential to BER supported research is the use of DOE's computational resources and the development of computational models that can be used to make experimentally testable predictions about climate, complex subsurface environments, or biological systems across the various spatial and temporal scales.

Major scientific goals for BER include:

- **Genomic Science** conducts explorations of microbes and plants at the molecular, cellular, and community levels. The goal is to gain insights about fundamental biological processes and, ultimately, a predictive understanding of how living systems operate. A 2006 National Research Council review of the Genomic Science activity[a] supports and encourages the focus on microbes and plants and states that "systems biology research is needed to develop models for predicting the behavior of complex biological systems."
- **Radiological Sciences** support research in radiochemistry and radiotracer development with the goal of developing new methodologies for real-time, high-resolution imaging of dynamic biological systems. This goal is supported by a 2008 community-based workshop, "New Frontiers of Science in Radiochemistry and Instrumentation for Radionuclide Imaging."[b] Radiobiology provides systems level research to understand radiation-induced perturbations of physiological processes.
- **Climate Research** supports research in atmospheric and environmental systems, and predictive climate and Earth system models. This research is guided by a 2008 report by the BER Advisory Committee entitled, "Identifying Outstanding Grand Challenges in Climate Change Research: Guiding DOE's Strategic Planning."[c] The report recommended that BER research "seek to understand Earth's climate system by characterizing current climate and its evolution over the last century to its present state, predicting regional climate change for the next several decades, and simulating Earth System changes and their consequences over centuries."
- **Subsurface Biogeochemistry** seeks to understand the role that subsurface biogeochemical processes play in determining the fate and transport of contaminants including heavy metals and radionuclides. Computational models of coupled biological, geochemical, and hydrological processes are needed to predict the rates and kinetics of transformation and sequestration of these critical DOE contaminants. This research is guided by an August 2009 community-based workshop, "Subsurface Complex System Science—with Relevance to Contaminant Fate and Transport."[d]

Subprograms

To accomplish its mission and address the scientific challenges described above, the BER program is organized into two subprograms, Biological Systems Science and Climate and Environmental Sciences.

- The *Biological Systems Science* subprogram explores the fundamental principles that drive the function and structure of living systems. The target systems range from microbes and microbial communities to plants and other whole organisms. Using the genome as a blueprint, Genomic Sciences provides the foundational biological understanding of microbial and plant systems in a range of natural and managed ecosystems. Three DOE Bioenergy Research Centers (BRCs)—led by Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, and the University of Wisconsin at Madison in partnership with Michigan State University—support multidisciplinary teams of leading scientists whose goal is to accelerate transformational breakthroughs needed to understand the conversion of cellulose (plant fibers) to biofuels. The Joint Genome Institute (JGI), a high-throughput DNA sequencing user facility, provides the basis for systems biology and unmatched capabilities to understand and predict the function of environmental and energy-related microbes and plants. Current sequencing capacity at the JGI is over 1,000 billion base pairs per year (compared to about 3 billion base pairs for the entire human genome) and growing rapidly. To understand the proteins encoded by DNA, the Structural Biology activity supports access to DOE's world-class synchrotron and neutron sources. The interface between biology and the physical sciences is explored in the Radiological Sciences with new methods for real-time high resolution imaging of dynamic biological processes and with molecular and genomic biology to underpin radiation risk policy.

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[a] http://www.nap.edu/catalog/11581.html

[b] http://www.sc.doe.gov/ober/radiochem_2008workshop_report.pdf

[c] http://www.sc.doe.gov/ober/berac/Grand_Challenges_Report.pdf

[d] August 2009 workshop report to be available early 2010.

- The *Climate and Environmental Sciences* subprogram advances science to understand, predict, and mitigate the impacts of energy production and use on climate change. Atmospheric System Research supports data collection and experimentation to help resolve the greatest uncertainties in climate change—the role of clouds and aerosols in Earth's radiation balance. The Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) provides key observational data to the climate research community on the radiative properties of the atmosphere, especially clouds. The facility includes highly instrumented ground stations, two mobile facilities, and an aerial vehicles program; it served 1000 users from around the world in FY 2009. Climate and Earth System Modeling supports some of the world's most powerful and sophisticated climate models that contribute to reports by the Intergovernmental Panel on Climate Change. In FY 2011, BER will initiate efforts for uncertainty quantification in climate models, incorporation of observational data sets, model development testbeds, and the development of numerical methods to enable climate models to use future computing architectures. Integrated Assessment research develops models to identify options for and costs of climate change mitigation. Environmental Systems Science supports research to understand the impact on and role of diverse ecosystems on climate change, as well as subsurface biogeochemical research to understand and predict subsurface contaminant fate and transport. The Environmental Molecular Sciences Laboratory (EMSL) serves 600–700 users annually and houses an unparalleled collection of state-of-the-art capabilities, including a supercomputer and over 60 major instruments, providing integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences. EMSL also contributes to systems biology by providing leading edge capabilities in proteomics.

Benefits

BER science continues to have broad benefits for society and for science. BER's long history of biological discovery has advanced scientific discovery, improved human health, and revolutionized the field of biology. Perhaps the most revolutionizing event was BER's initiation of the Human Genome Project. Built on the strength in technology development at DOE's national laboratories, the Human Genome Project led to the determination of the complete DNA sequence of the human genome, information that has provided unprecedented opportunities for discovering and understanding fundamental principles of life. Today, DNA sequencing is the foundation for BER research on plants and microbes with an emphasis on organisms with energy and environmental relevance leading to the discovery of novel microorganisms with unanticipated biotechnological capabilities and provided new insights into a variety of plants including trees, legumes and grasses.

From research to understand the health effects of exposure to radiation we learned of the sensitivity of embryos to radiation, developed assays using mice and the bacteria to quantify the mutagenic potential of radiation and chemicals, and discovered the genes and mechanisms responsible for the repair of damaged DNA. Today, BER research has shown that biological responses to low and high doses of radiation are both quantitatively and qualitatively different, suggesting that the traditionally used linear no-threshold model for assessing radiation risk is not scientifically justified.

Early DOE studies to understand the fate of radioactive fallout on land and in the oceans also had broad impacts, leading to the development of modern ecology and oceanography, tools to understand the intricacies of Earth's climate system, and modeling capabilities for predicting future climate. Today, our growing understanding of the climate system and our ability to more accurately predict future climate are essential to plan for future energy needs, water resources, and land use. BER research also provides new understanding of the biological, physical, and chemical mechanisms responsible for the natural sequestration of carbon dioxide in terrestrial ecosystems, knowledge that is useful in understanding the impacts of land use and land management decisions on carbon release or storage from various ecosystems.

Fundamental, hypothesis-driven research in both laboratories and the field has revealed new biogeochemical processes that influence the fate and transport of contaminants from a legacy of weapons production. Today, this knowledge has been translated into new strategies for cleaning up legacy contaminants based on understanding of the broad capabilities of naturally occurring subsurface microbes.

Program Planning and Management

BER uses broad input from scientific workshops and external reviews, such as those performed by the National Academies, to identify current and future scientific and technical needs and challenges in current national and international research efforts. BER also receives advice from the Biological and Environmental Research Advisory Committee (BERAC) on the management of its research programs (through Committee of Visitor [COV] reviews), on the direction and focus of its research programs, and on strategies for long-term planning and development of its research activities. A key focus of BERAC activities is to identify the greatest scientific challenges in biological, climate, and environmental systems science that BER should address in the long-term (20-year horizon) and how BER should be positioned to address those challenges; the continued or new fields of BER-relevant science that DOE will need to achieve its future mission challenges; and the future scientific and technical advances needed to underpin BER's complex systems science.

The BER program is coordinated with activities of other federal organizations supporting or conducting complementary research, e.g., the National Science Foundation, National Aeronautics and Space Administration, Department of Commerce/National Oceanic and Atmospheric Administration, Environmental Protection Agency, Nuclear Regulatory Commission, Department of Agriculture, National Institutes of Health, Department of State, and Department of Defense. BER Climate Change Research is coordinated with the U.S. Global Change Research Program, an interagency program codified by Public Law 101–606 and involving thirteen federal agencies and departments, and the U.S. Climate Change Technology Program.

BERAC conducts reviews of BER subprograms by COVs every three years. Results of these reviews and BER responses are posted on the Office of Science website.[a] Every three years, BER also conducts consolidated onsite merit, operational, management, and safety reviews of each of its user facilities, the Atmospheric Radiation Measurement Climate Research Facilities, the Joint Genome Institute, and the Environmental Molecular Sciences Laboratory. Results of these reviews are used to address management, scientific, operational, and safety deficiencies.

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[a] http://www.science.doe.gov/SC-2/Committee_of_Visitors.htm

BER supports research at universities, research institutes, private companies, and DOE national laboratories. All BER-supported research undergoes regular peer review and merit evaluation based on procedures established in 10 CFR 605 for the external grant program and using a similar process for research at the national laboratories.

Basic and Applied R&D Coordination

BER research underpins the needs of DOE's energy and environmental missions. Fundamental research on microbes and plants to understand their biochemical pathways and the genetic mechanisms that control their interactions and behavior provides knowledge needed by DOE's Office of Energy Efficiency and Renewable Energy and the U.S. Department of Agriculture about new bioenergy crops and bioenergy production facilities that are cost effective and sustainable. BER research on the behavior and interactions of contaminants in the subsurface environment provides knowledge needed by DOE's Office of Environmental Management to develop new strategies for the remediation of weapons-related contaminants at DOE sites and by DOE's Office of Legacy Management to develop tools for monitoring the long-term status of contaminants at cleanup sites. Knowledge of the subsurface environment as a complete system will also be useful to the DOE Office of Fossil Energy in their efforts to predict the long-term behavior of carbon dioxide injected underground for long-term storage. Finally, BER research to understand Earth's climate system and to predict future climate and climate change is needed by DOE's Office of Policy and International Affairs as it develops strategies for our Nation's future energy needs and control of greenhouse gas emissions.

Budget Overview

BER's budget strategy is based on three mission priorities: exploring the frontiers of genome-enabled biology; discovering the physical, chemical, and biological drivers and environmental impacts of climate change; and seeking the geochemical, hydrological, and biological determinants of environmental sustainability and stewardship. The BER scientific user facilities are key to supporting these mission priorities.

Genomic science research supported in FY 2011, including the DOE Bioenergy Research Centers, will continue to advance our understanding of how plant and microbial system functions are specified by genome organization, expression, and regulation. This includes developing genomic, analytical, and computational approaches to study the structure, interdependence, and function of microbial communities and the identification of plant traits for improved bioenergy production or carbon sequestration. The JGI will continue to support sequencing needs of the Genomic Science program, especially the Bioenergy Research Centers. JGI activities will reflect the steady increase in production DNA sequencing as well as the resulting need for high-throughput, complex genome annotation and analysis.

Climate sciences research supported in FY 2011 will continue to improve understanding and quantification of the role of aerosols and clouds on climate change. New ARM sites and laboratory studies will support research in locations with different types of clouds, atmospheric conditions, and aerosol loadings to better address major outstanding questions in climate change research (clouds and aerosols). Results will be used to evaluate and improve performance of regional and global climate models. New efforts in FY 2011 will focus on uncertainty quantification in climate models, incorporation of observational data sets, and model development testbeds. Additional funding for Climate and Earth System modeling will support efforts to improve uncertainty quantification, streamline the translation of observational data sets, create model development testbeds, and develop new numerical methods to enable climate models to use future computing architectures. Efforts will continue on the development of an additional large-scale, manipulative experiment in the arctic tundra to improve understanding of the impacts of climate change on ecosystem structure and function. Research will be expanded to improve understanding of the role of terrestrial ecosystems as sources and sinks of greenhouse gases focusing on the role of natural processes that control terrestrial carbon sequestration and how those processes might be managed to enhance carbon sequestration in terrestrial ecosystems.

Subsurface Biogeochemical Research will support basic research on the fate and transport of contaminants in the subsurface. This research addresses unique physical, chemical, and biological processes controlling the flux of contaminants across and within the root zone of soils and the flux of contaminants to surface water bodies. Processes in these critical zones influence fluxes of carbon and key nutrients between the atmosphere and terrestrial biosphere. The EMSL equipment refresh will continue to keep EMSL at the state of the art, including enhancement of leading capabilities in proteomics and advanced magnetic resonance.

Significant Program Shifts

In FY 2011, BER will initiate enhanced activities in climate modeling, including improving uncertainty quantification, streamlining the translation of observational data sets, creating model development testbeds, and developing new numerical methods. These activities will help to accelerate the advance of climate models. BER research on the development of the components of an artificial retina is completed in FY 2010. The BER effort will end in FY 2011 with the final testing of the assembled 240+ electrode device. In FY 2011, BER will continue to actively work with NIH and industry to identify an appropriate transition route that will move the artificial retina project from research into early development and application.

Annual Performance Targets and Results

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering

GPRA Unit Program Goal: Biological and Environmental Research (BER) Program Goal: Harness the Power of Our Living World—Provide the biological and environmental discoveries necessary to clean and protect our environment, offer new energy alternatives, and facilitate the entrainment of physical science advances in biology.

Annual Performance Measure: Determine the dominant processes controlling the fate and transport of contaminants in subsurface environments and develop quantitative numerical models to describe contaminant mobility at the field scale.

FY 2006	T: Develop predictive model for contaminant transport that incorporates complex biology, hydrology, and chemistry of the subsurface. Validate model through field tests. A: Goal met
FY 2007	T: Implement a field-oriented, integrated experimental research program to quantify coupled processes that control reactive transport of at least one key DOE contaminant. A: Goal met
FY 2008	T: Identify the critical redox reactions and metabolic pathways involved in the transformation/ sequestration of at least one key DOE contaminant in a field environment. A: Goal met

FY 2009	T: Test geophysical techniques that measure parameters controlling contaminant movement under field conditions in at least two distinct subsurface environments. A: Goal met
FY 2010	T: Develop a reactive transport model for a complex field site that accounts for heterogeneity and objectively evaluate against field data. A: TBD
FY 2011	T: Refine subsurface transport models by developing computational methods to link important processes impacting contaminant transport at smaller scales to the field scale. A: TBD
FY 2012	T: Perform time-lapse geophysical experiments to monitor spatial and temporal dynamics of hydrogeological and biogeochemical parameters impacting contaminant transport processes. A: TBD
FY 2013	T: Use genomics-based methods to predict the activity of subsurface microbial communities and their influence on the transport of contaminants in the subsurface. A: TBD
FY 2014	T: Use geophysical signatures to locate and define key biogeochemical zones in subsurface environments that impact contaminant transport processes. A: TBD
FY 2015	T: Integrate genomic-based methods of predicting microbial community activity into computational models describing contaminant transport. A: TBD

Annual Performance Measure: Increase by at least 10% the number of high quality (less than one error in 10,000) bases of DNA from microbial and model organism genomes sequenced the previous year, and decrease by at least 10% the cost (billion base pair/dollar) to produce these base pairs from the previous year's actual results.[a]

FY 2007	T: Sequence 40 billion base pairs (bp) at a rate of 644 bp/$1. A: Goal not met
FY 2008	T: Sequence 42.8 billion base pairs at a rate of 785 bp/$1 A: Goal met

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[a] This performance measure begins in FY 2007.

FY 2009	T: Sequence 253 billion base pairs at a rate of 4,600 bp/$1. A: Goal met
FY 2010	T: Sequence 1,100 billion base pairs at a rate of 15,942 bp/$1. A: TBD
FY 2011	T: TBD based on FY 2010 results A: TBD
FY 2012	T: TBD based on FY 2011 results A: TBD
FY 2013	T: TBD based on FY 2012 results A: TBD
FY 2014	T: TBD based on FY 2013 results A: TBD
FY 2015	T: TBD based on FY 2014 results A: TBD

Annual Performance Measure: Develop a coupled climate model with fully interactive carbon and sulfur cycles, as well as dynamic vegetation to enable simulations of aerosol effects, carbon chemistry, and carbon sequestration by the land surface and oceans and the interactions between the carbon cycle and climate.

FY 2006	T: Produce a new continuous time series of retrieved cloud properties at each ARM site and evaluate the extent of agreement between climate model simulations of water vapor concentration and cloud properties and measurements of these quantities on time scales of 1 to 4 days. A: Goal met
FY 2007	T: Provide new mixed-phase cloud parameterization for incorporation in atmospheric GCMs and evaluate extent of agreement between climate model simulations and observations for cloud properties in the arctic. A: Goal met
FY 2008	T: Report results of decade-long control simulation using geodesic grid coupled climate model and produce new continuous time series of retrieved cloud, aerosol, and dust properties, based on results from the ARM mobile facility deployment in Niger, Africa. A: Goal met

FY 2009	T: Provide improved climate simulations on subcontinental, regional, and large watershed scales, with an emphasis on improved simulation of precipitation and produce new continuous time series of retrieved cloud, aerosol, and radiation for Arctic region. A: Goal met
FY 2010	T: Provide a new parameterization for aerosol effects on cloud drizzle for incorporation into atmospheric models. A: TBD
FY 2011	T: Earth system model to be used in generating scenarios for the IPCC Fifth Assessment Report and provide integrated aerosol sub-model that includes direct and indirect forcing. A: TBD
FY 2012	T: Demonstrate coupled climate models at 20km resolution. A: TBD
FY 2013	T: Provide peer reviewed publications documenting effects of experimental warming on the regeneration of key plant species at a high-elevation and a high-latitude ecotone (i.e., boundary between two adjacent ecosystem types) in the United States. A: TBD
FY 2014	T: Provide a comparative analysis of measured and modeled biosphere atmosphere fluxes of carbon at the subcontinent scale using data products from the AmeriFlux Network and new versions of integrated terrestrial carbon cycle models. A: TBD
FY 2015	T: Provide progress report for scientific results from next generation ecosystem experiment. A: TBD

Annual Performance Measure: The achieved operation time of the JGI scientific user facility as a percentage of the total scheduled annual operating time is greater than 98%.

FY 2006	T: 98% of total scheduled operating time A: Goal met
FY 2007	T: 98% of total scheduled operating time A: Goal met
FY 2008	T: 98% of total scheduled operating time A: Goal not met

FY 2009	T: 98% of total scheduled operating time A: Goal met
FY 2010-FY2015	T: 98% of total scheduled operating time A: TBD

Annual Performance Measure: The achieved operation time of the ARM/ACRF scientific user facility as a percentage of the total scheduled annual operating time is greater than 98%.

FY 2006	T: 98% of total scheduled operating time A: Goal met
FY 2007	T: 98% of total scheduled operating time A: Goal met
FY 2008	T: 98% of total scheduled operating time A: Goal met
FY 2009	T: 98% of total scheduled operating time A: Goal met
FY 2010-FY 2015	T: 98% of total scheduled operating time A: TBD

Annual Performance Measure: The achieved operation time of the EMSL scientific user facility as a percentage of the total scheduled annual operating time is greater than 98%.

FY 2006	T: 98% of total scheduled operating time A: Goal met
FY 2007	T: 98% of total scheduled operating time A: Goal met
FY 2008	T: 98% of total scheduled operating time A: Goal met
FY 2009	T: 98% of total scheduled operating time A: Goal met
FY 2010-FY 2015	T: 98% of total scheduled operating time A: TBD

Biological Systems Science

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Biological Systems Science			
Genomic Science	0	165,626	176,891
Radiological Sciences	0	46,615	42,327
Ethical, Legal, and Societal Issues	0	5,000	5,000
Medical Applications	0	8,226	4,000
Biological Systems Facilities and Infrastructure	0	84,300	84,950
SBIR/STTR	0	8,709	8,779
Total, Biological Systems Science	0[a]	318,476	321,947

Description

Systems biology is the holistic, multidisciplinary study of complex interactions that specify the function of an entire biological system—whether single cells or a multicellular organism—rather than the reductionist study of individual components. The Biological Systems Science subprogram focuses on understanding the functional principles that drive living systems, systems ranging in scale from microbes and microbial communities to plants and other whole organisms. Questions asked in the subprogram include: What information is contained in the genome sequence? How is information integrated and processed in a coordinated manner between the different subcellular constituents? What are the key molecular interactions that regulate the overall response of the living system and how can those interactions be understood in a dynamic and predictive way? The systems biology approaches employed include genome sequencing, proteomics, metabolomics, structural biology, high-resolution imaging and characterization, and integration of the resulting information into predictive computational models of biological systems that can be functionally tested and validated.

The subprogram supports multidisciplinary research primarily focused on microbial and plant systems, as well as operations of the subprogram's primary research facility, the DOE Joint Genome Institute, and access to structural biology facilities. Support is also provided for research at the interface between the biological and physical sciences and in radiochemistry and instrumentation research to develop new methodologies for real-time, high-resolution imaging of dynamic biological processes in energy- and environment-relevant contexts.

Selected FY 2009 Accomplishments

- The DOE Bioenergy Research Centers have pioneered a variety of new research and technological approaches designed to accelerate biofuels research. The Joint BioEnergy Institute combined carbohydrate arrays and nano-scale mass spectrometry to rapidly screen novel environmental microbes and identify new cellulose-degrading enzyme activities against a wide range of plant compounds. The Great Lakes Bioenergy Research Center used systems biology methods to identify microbial community interactions during biomass deconstruction in natural systems, with potential to augment development of novel approaches for biofuel production. Research on consolidated bioprocessing at the BioEnergy Science Center provided new insights on how microbes fine tune their enzyme systems to optimize efficiency while breaking down complex plant material. New analytical technologies were developed for characterizing biological processes in systems being studied for production of biofuels and for other DOE missions. Research in mass spectrometry enabled study of uncharged molecules, such as lipids, by state-of-the-art instrumentation and the rapid, accurate measurement of metabolites produced in essential pathways in microbial systems. Fourier Transform infrared spectromicroscopy at the Advanced Light Source (ALS) enabled continuous tracking of cellular chemistry within living microbes as they adapt to changing chemical environments. A high-throughput pipeline for small angle x-ray scattering was developed and implemented at another experimental station at the ALS that will allow the three dimensional shapes of proteins and protein complexes to be determined in large numbers. This information will provide significant insights into the function of a cell's proteins and complexes.

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[a] Associated FY 2009 funding of $313,688,000 is included within the previous Biological Research subprogram. Modifications were made to the budget structure to better reflect the subprogram's activities starting in FY 2010.

- The DOE Joint Genome Institute (JGI) significantly expanded its role in large-scale genome sequencing and analysis in support of DOE missions. Major accomplishments include the use of new sequencing technologies to sequence a trillion base pairs of DNA annually, the sequencing of the genome of sorghum (a major candidate biofuels crop with ability to withstand drought and prosper on marginal land), and substantial progress on sequencing the genome of a single microbial cell (critical to exploring the gene content of the huge majority of microbial species that cannot be easily cultivated). The JGI also developed enhanced data analysis tools for sequencing communities of organisms (metagenomes), providing fundamental insights into the behavior of microbes in natural environments.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Genomic Science	**0**	**165,626**	**176,891**
▪ **Foundational Genomics Research**	**0**	**33,216**	**40,081**

The Foundational Genomics Research activity supports fundamental research on microbes and plants, with an emphasis on understanding biological systems across multiple scales of organization, ranging from subcellular protein-protein interactions to complex microbial community structures. At the subcellular level, this research focuses on the characterization and spatial organization of cellular components and the regulatory and metabolic networks of microbes and plants. It investigates how cells are able to balance dynamic needs for synthesis, assembly, and turnover of cellular machinery in response to changing signals from the environment. Foundational genomic research will increasingly focus on understanding how different organisms interact within a biological or environmental system to provide unique functions through mechanisms such as commensal nutrient flow or horizontal gene transfer. These systems-level capabilities allow a broad diversity of functions, ranging from microbial respiration and speciation of soil minerals to rhizosphere nutrient uptake and cell-cell communication, as well as a testable framework for development of genome-based models for systems biology. Research also includes the development of new biotechnological approaches specifically designed for systems biology, including methods to measure metabolites, proteins, and expressed genes for microbial communities. Research will also support the development of novel technologies to enable multi-modal chemical and biological measurements across broad spatial and temporal ranges, to provide insight into actively-occurring environmental processes. The emphasis is on research that employs advanced molecular and computational biology approaches enabled by genome sequencing and emphasizes multidisciplinary efforts combining expertise in microbiology, plant biology, chemistry, biophysics, bioinformatics, metabolic engineering, and other fields.

In FY 2011, research is increased to advance the understanding of how complex biological system function is specified by genome organization, expression, and regulation, through the development of genomic and analytical technologies for multi-modal, dynamic measurements in actively-occurring environmental processes.

FY 2009 funding of $36,839,000 was funded in Molecular and Cellular Biology within the Biological Research subprogram.

- **Genomics Analysis and Validation** **0** **10,000** **10,000**

The Genomics Analysis and Validation activity develops the tools and resources needed to fully exploit the information contained in complete DNA sequences from microbes and plants for bioenergy, carbon sequestration, and bioremediation applications. This activity supports development of new strategies and tools capable of high-throughput, genome-wide experimental and analytic approaches for complex biological systems.

New high-throughput approaches for analyzing gene regulation and function, automated annotation tools for predicting genes and protein function from DNA sequence, and tools for identifying dynamic genome interactions within a biological or environmental system are essential for uncovering emergent properties of interacting genes. The ability to predict the function of an individual gene and sets of genes is essential for design and validation of strategies for bioenergy production, enhanced carbon sequestration, or environmental remediation.

In FY 2011, research supports innovative new approaches for the experimental validation and improvement of genome-scale annotation and gene models in microbes, plants, and complex biological systems.

FY 2009 funding of $10,000,000 was funded in Human Genome within the Biological Research subprogram.

- **Metabolic Synthesis and Conversion** **0** **39,127** **39,127**

This activity focuses on understanding biological pathway composition and regulation to effect conversion of carbon from simple precursor forms into advanced biomolecules. Fundamental research focuses on understanding carbon uptake, fixation, and storage in plants and soil microbes, strongly leveraging the increasing availability of information from whole organism genomes and community metagenomes. Research will also focus on understanding the role that microbial communities or plant-microbe associations play in the transfer of carbon between the roots and the soil to identify strategies that would lead to increased carbon storage in the rhizosphere and surrounding soil. Genome-based knowledge of metabolic functions and regulatory networks in microbial systems, plants, and plant-microbe associations can enable strategies to increase biomass formation for conversion into advanced biofuels or to increase the sequestration of carbon in terrestrial ecosystems.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

While this activity draws upon the foundational research and technology development within the broader Genomic Sciences portfolio, it will specifically address challenges unique to advancing biofuels through understanding the metabolic conversion of simple sugars to ethanol and hydrogen. This will lead to improved understanding of environmental variables governing partitioning of energy precursors into different biomass, respiration, or energy producing pathways, or fixation into recalcitrant soil or marine carbon forms. Systems biology approaches are supported to understand how plant genomes can specify increased carbon fixation and biomass yield, improved feedstock characteristics, and sustainability.

In FY 2011, funds will continue to support research on carbon storage in plant biomass for conversion into advanced biofuels or for carbon sequestration. Funds will also support research focused on the characterization and regulation of carbon and nutrient cycling in plant and microbial systems, from subcellular or root-stem-leaf partitioning to flux within pathways or between networks of interacting organisms within a biological system.

FY 2009 funding of $43,814,000 was in Molecular and Cellular Biology within the Biological Research subprogram.

	FY 2009	FY 2010	FY 2011
• **Computational Biosciences**	**0**	**8,283**	**12,683**

Computational models and the necessary algorithmic and computational tools needed to describe the biochemical capabilities of microbial communities or plants are essential to the success of the BER Genomic Sciences activity. The models are needed to integrate diverse data types and data sets—from experiments using genomics, proteomics, and metabolomics—into single models, and they must accurately describe and predict the behavior of metabolic pathways and genetic regulatory networks. A systems biology knowledgebase is an integrated experimental framework for accessing comparing, analyzing, modeling, and testing systems biology data. The extension of capabilities beyond data generation and storage to data retrieval, data access, and cross-database comparative computational modeling forms the basic requirements of a systems biology knowledgebase. This will enable and provide support for progressively more precise and comprehensive predictive modeling of various catalytic and cellular processes, organisms, and communities. The systems biology knowledgebase dimensions and requirements were recently outlined in a community workshop. (see http://genomicscience.energy.gov/compbio/)

A knowledgebase framework is needed to compare and integrate mission critical data and information in a precise and comprehensive manner to develop bioenergy, carbon sequestration, or bioremediation strategies. This activity includes support for ongoing Scientific Discovery through Advanced Computing (SciDAC) research that develops multi-scale and multi-component mathematical and computational tools needed for modeling and analysis of complex data sets, such as mass spectrometry or metabolomics, and to develop predictive metagenomic models of complex microbial communities. The research is closely coordinated with Office of Science's Advanced Scientific Computing Research program.

In FY 2011, funding will support ongoing SciDAC research on the modeling of whole cellular processes that incorporate models of genomic information and protein production and function with metabolic, regulatory, and cellular signaling processes. Increased funding includes support to establish a system biology modeling framework, allowing open access to researchers to biological

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

data and analytical tools. The framework will include biological database research and development, new software and algorithm research for interoperability among databases and datasets, and will develop and test predictive models for microbial systems of DOE relevance with respect to physiological properties, behavior, and whole microbe and microbial community responses. The framework will enable broad, distributed access to a virtual computational environment, allowing integrated genome-scale modeling and reconstruction, using microbial experimental datasets from genome sequencing, biological networks and metabolic pathways, and transcriptional regulation and phenotypic data. The primary microbial experimental datasets for integration will be drawn from research conducted at the DOE Bioenergy Research Centers, the Joint Genome Institute, and from within the Genomic Science activity.

FY 2009 funding of $5,094,000 was in Molecular and Cellular Biology within the Biological Research subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Bioenergy Research Centers**	**0**	**75,000**	**75,000**

In 2007, BER established three Bioenergy Research Centers to accelerate the transformational breakthroughs in basic science needed for the development of cost-effective technologies to make production of cellulosic (plant-fiber based) biofuels commercially viable on a national scale.

The Centers each represent a multidisciplinary, multi-institutional partnership between universities, national laboratories, and the private sector. The Centers take scientific approaches that are complementary and synergistic. Areas of fundamental research include the identification, characterization, and systems-level regulation of genetic traits for cell wall composition of model plants such as Arabidopsis and rice, for which detailed genome sequence and phenotypic information are available, as well as second-generation bioenergy crops such as poplar and switchgrass for which there are more limited genomic resources. Other studies focus on understanding the metabolic pathways in individual microbes or microbial consortia that carry out efficient degradation of cell wall material and conversion into ethanol, hydrocarbons, diesel, and even jet fuel. The Centers also focus on modeling structure-function relationships in enzymes and proteins important in the synthesis, turnover, and remodeling of plant cell wall biomass, as well as subsequent metabolic and enzymatic conversion.

Annual progress of each center is evaluated by an on-site review of science and management activities and progress against stated milestones. The external review teams are comprised of scientists from universities, DOE national laboratories, and industry, with expertise in systems biology, microbial physiology and genetics, plant genomics and bioinformatics, genomic database management and informatics, and analytical chemistry. All three centers are evaluated for progress against milestones and for the planned science programs.

The Centers are using the advanced, genomics-based techniques of modern systems biology to re-engineer both plants and microbes for more efficient biologically-based conversion of plant fiber into carbon-neutral biofuels. This capability addresses critical DOE mission needs in the area of secure and sustainable bioenergy production.

In FY 2011, funds will support the continued work of the three DOE Bioenergy Research Centers to pursue fundamental research focused on improving breakdown of plant biomass, discovery and

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

bioengineering of new microbes and enzymes capable of degrading lignocellulose, and conversion of cellulose-derived sugars to carbon-neutral biofuels.

FY 2009 funding of $75,000,000 was in Molecular and Cellular Biology within the Biological Research subprogram.

Radiological Sciences	**0**	**46,615**	**42,327**
▪ **Radiochemistry and Imaging Instrumentation**	**0**	**20,688**	**18,400**

The activity supports fundamental research in radiochemistry and radiotracer development activities that include development of new methodologies for real-time, high-resolution imaging of dynamic biological processes in energy- and environment-relevant contexts. Radionuclide imaging continues to stand out as a singular tool for studying living organisms in a manner that is highly quantitative, three dimensional, temporally dynamic, and non-perturbative of the natural biochemical processes under study.

Radiotracer imaging methods provide new opportunities for quantitative measurement of *in situ* chemical reactions in living systems. The activity encompasses applications of new innovative technologies for biological systems with primary benefits for DOE mission needs while also providing fundamental research and tool development that may translate to nuclear medicine diagnostic and therapeutic research.

In FY 2011, funds will support improvements in synthetic radiochemical methods, new radiotracer design, and the development of multimodality tracers. These new approaches will be combined with advanced imaging instrumentation and detectors, to expand the opportunities for non-perturbative study of microbial and plant metabolism, and for tracking dynamic processes in the environment. Funding will also continue to support integrative training opportunities in radiochemistry to ensure the future availability of human resources for important radiochemistry applications. Two year activities funded in FY 2010 to develop new radiochemistry synthetic and detection methods will not require additional funding and will be completed in FY 2011.

FY 2009 funding of $22,811,000 was in the Radiochemistry and Instrumentation activity within the Biological Research subprogram.

▪ **Radiobiology**	**0**	**25,927**	**23,927**

The Radiobiology activity supports research that will help determine health risks from exposures to low levels of ionizing radiation, information critical to adequately and appropriately protect radiation workers and the general public. Research investigations include a number of critical biological phenomena induced by low dose exposure including adaptive responses, bystander effects, genomic instability, and genetic susceptibility. This activity includes support for understanding the role of epigenetics in integrated gene function and response of biological systems to environmental conditions, including low dose radiation.

This activity will provide a scientific basis for informed decisions regarding remediation of contaminated DOE sites and for determining acceptable levels of human health protection, both for cleanup workers and the public in the most cost-effective manner.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

In FY 2011, funds will support the development of models that integrate responses to low dose radiation at the tissue or whole organism level with available epidemiological and epigenetic data to contribute to developing safe and appropriate radiation protection standards and the development of systems genetic strategies for integrated gene function and response to the environment. Research on DNA damage from low dose radiation exposure is completed in FY 2011, requiring no FY 2011 funding.

FY 2009 funding of $20,667,000 and $5,937,000 was in Molecular and Cellular Biology and Health Effects, respectively, within the Biological Research subprogram.

Ethical, Legal, and Societal Issues	**0**	**5,000**	**5,000**

ELSI research supports activities applicable to Office of Science interests in bioenergy, synthetic biology, and nanotechnology, including exploration and communication of the societal implications arising from these programs. The ecological and environmental impacts of nanoparticles resulting from nanotechnology applied to energy technologies will be studied. The research will be coordinated across the Office of Science and with other relevant Federal agencies and offices, such as the Environmental Protection Agency, National Science Foundation, and Office of Science and Technology Policy.

The ELSI program takes a proactive stance to anticipate societal benefits and implications of science and contributes to the informed choices society makes to implement scientific knowledge.

In FY 2011, funding is provided to support explorations of the potential societal implications arising from scientific research in areas of systems microbiology, synthetic genomics, sustainable bioenergy crop production, and nanotechnology in the environment.

FY 2009 funding of $5,000,000 was in Human Genome within the Biological Research subprogram.

Medical Applications	**0**	**8,226**	**4,000**

Research continues to utilize resources of the national laboratories in material sciences, engineering, microfabrication, and microengineering to develop an artificial retina to restore sight to the blind. DOE's goal for the artificial retina project is to develop the technology underpinning the ultimate fabrication of a 1,000+ electrode intraocular device that will allow a blind person to read large print, recognize faces, and move around without difficulty.

The Artificial Retina activity enables scientists to work together across disciplines and promotes scientific and technological innovation at the interface between biology and the physical sciences. The results will benefit not only human health but also other DOE-relevant areas such as sensor development for environmental monitoring. BER research on the development of the components of the 240+ electrode artificial retina device is completed in FY 2010.

In FY 2011, BER continues to actively work with NIH and industry to identify an appropriate transition route that will move the artificial retina project from research into early development and application. Funding is provided to support device integration, quality assurance and quality control, and preparation for pre-clinical trials.

FY 2009 funding of $8,226,000 was in Medical Applications within the Biological Research subprogram.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Biological Systems Facilities and Infrastructure	**0**	**84,300**	**84,950**
- **Structural Biology Infrastructure**	**0**	**15,300**	**15,683**

The Structural Biology Infrastructure activity continues to develop and support access to beamlines and instrumentation at DOE's national user facilities for the Nation's structural biologists. BER coordinates, with the NIH and NSF, the management and maintenance of 22 experimental stations at several DOE synchrotrons (Advanced Photon Source [APS], Advanced Light Source [ALS], and Stanford Synchrotron Radiation Laboratory [SSRL]) and neutron sources (High Flux Isotope Reactor [HFIR] and Los Alamos Neutron Science Center [LANSCE]). User statistics for all BER structural biology user facilities are included in the Basic Energy Sciences (BES) facility user reports. BER continually assesses the quality of the instrumentation at its experimental stations and supports upgrades to install the most effective instrumentation for taking full advantage of the facility capabilities.

The Structural Biology infrastructure enables a broad user community to conduct the high-resolution study of biological molecules involved in cellular architecture, biocatalysis, environmental sensing, and carbon capture. It advances and promotes scientific and technological innovation in support of the DOE mission.

In FY 2011 funds will continue to support biological community access to structural biology beamlines and instrumentation at DOE national user facilities.

FY 2009 funding of $15,300,000 was in Structural Biology within the Biological Research subprogram.

- **Joint Genome Institute**	**0**	**69,000**	**69,267**

The Joint Genome Institute (JGI) is the only federally-funded large genome center focusing on genome discovery and analysis in plants and microbes for energy and environmental applications. This unique status has enabled it to contribute valuable information through the large-scale genome sequencing of bioenergy crops such as sorghum, maize, poplar, and soybean, as well as targeted sequencing of gene expression sets for switchgrass, cotton, wheat, and conifers. The JGI provides the genomic blueprint which is the basis for systems biology of plants and environmental microbes. Through the development of genome assembly algorithms, tools for comparative gene and pathway analysis, and systems-level integration of data from multiple sequencing technology and functional genomic platforms, the JGI has enabled researchers and plant breeders to identify key traits and genes for specific bioenergy applications or environmental conditions. In addition to a broad reference set of laboratory cultured microbes, the JGI has pioneered approaches for sequencing uncultured, environmental microbial isolates and microbial communities. These metagenomic capabilities will eventually allow elucidation of the functional potential of all the biological organisms that comprise a specific environmental system.

The JGI provides DOE mission-relevant genome sequencing, genome data acquisition, and genome analysis to the broad scientific user community, DOE national laboratories, and the Bioenergy Research Centers. This suite of high-throughput tools, technologies, and comparative analytical capabilities serve as a discovery platform for understanding the organization and function of

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

complex genomes. This genomic-level understanding is vital to the predictive design and engineering of microbial and plant systems for mission capabilities in bioenergy, carbon cycling and biosequestration, and environmental remediation and stewardship.

In FY 2011, funding will continue to support access by the scientific user community and the DOE Bioenergy Research Centers to integrative large-scale genome data acquisition and analysis of biological systems at the JGI. Funding will also support a greater emphasis on metagenome expression and sequencing of environmental microbial communities or the plant-microbe rhizosphere, improved genome annotation, and functional analysis and verification of genome-scale models.

FY 2009 funding of $65,000,000 was in Human Genome within the Biological Research subprogram.

		(estimated)	
	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	8,400	N/A	N/A
Planned Operating Hours	8,400	8,400	8,400
Optimal hours	8,400	8,400	8,400
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[a]	780	940	940

	FY 2009	FY 2010	FY 2011
SBIR/STTR	**0**	**8,709**	**8,779**

FY 2010 and FY 2011 amounts shown for the SBIR and STTR programs are the estimated requirements for continuation of these congressionally mandated programs.

	FY 2009	FY 2010	FY 2011
Total, Biological Systems Science	**0**	**318,476**	**321,947**

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[a] All JGI users are remote. Primary users are individuals associated with approved projects being conducted at the JGI in a reporting period. Each user is counted once per year regardless of how many proposals their name may be associated with. Different users may utilize vastly differing levels of JGI resources.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Genomic Science	
▪ **Foundational Genomics Research**	
Funding is increased to advance the understanding of how complex biological system function is specified by genome organization, expression and regulation, through the development of genomic and analytical technologies for multi-modal, dynamic measurements in actively-occurring environmental processes.	+6,865
▪ **Computational Bioscience**	
Funding is increased to develop a systems biology modeling framework to integrate microbiological experimental data sets from research conducted at the DOE Bioenergy Research Centers, the Joint Genome Institute, and the Genomic Science activity.	+4,400
Total, Genomic Science	**+11,265**
Radiological Sciences	
▪ **Radiochemistry and Imaging Instrumentation**	
The decrease reflects the completion in FY 2011 of multi-year activities initiated in FY 2010 (and funded for two years) in development of new radiochemistry synthetics and detection methods.	-2,288
▪ **Radiobiology**	
Research on DNA damage from low dose radiation exposure is completed in FY 2011 and requires no FY 2011 funding.	-2,000
Total, Radiological Sciences	**-4,288**
Medical Applications	
BER funding for the components of the Artificial Retina effort is completed with integration and pre-clinical testing of a 240 electrode retinal device as a basis for fabrication of the 1,000 electrode device. In FY 2011, BER will actively work with NIH and industry to identify a transition route that will move the artificial retina project from research into early development and application.	**-4,226**

	FY 2011 vs. FY 2010 ($000)
Biological Systems Facilities and Infrastructure	
▪ **Structural Biology Infrastructure**	
In FY 2011 funds will continue to support biological community access to structural biology beamlines and instrumentation at DOE national user facilities.	+383
▪ **Joint Genome Institute**	
Funding will support a greater emphasis on metagenome expression and sequencing of environmental microbial communities or the plant-microbe rhizosphere, improved genome annotation, and functional analysis and verification of genome-scale models.	+267
Total, Biological Systems Facilities and Infrastructure	**+650**
SBIR/STTR	
▪ SBIR/STTR increases as the funding for research increases.	+70
Total Funding Change, Biological Systems Science	**+3,471**

Climate and Environmental Sciences

Funding Schedule by Activity

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Climate and Environmental Sciences			
Atmospheric System Research	0	26,452	28,396
Environmental System Science	0	82,558	81,531
Climate and Earth System Modeling	0	69,775	85,622
Climate and Environmental Facilities and Infrastructure	0	99,479	101,333
SBIR/STTR	0	7,442	8,071
Total, Climate and Environmental Sciences	0[a]	285,706	304,953

Description

The Climate and Environmental Sciences subprogram focuses on a predictive, systems-level understanding of the fundamental science associated with climate change and DOE's environmental challenges—both key to support the DOE mission. The subprogram supports an integrated portfolio of research ranging from molecular to field scale studies with emphasis on the use of advanced computer models and multidisciplinary experimentation. Climate and Environmental Sciences supports three research activities and two national scientific user facilities. The Atmospheric System Research activity seeks to resolve the two major areas of uncertainty in climate change projections: the role of clouds and the effects of aerosol emissions on the atmospheric radiation balance. The Environmental System Science activity provides scientific understanding of the effects of climate change on terrestrial ecosystems, the role of terrestrial ecosystems in global carbon cycling, and the role of subsurface biogeochemical processes on the fate and transport of DOE-relevant contaminants including heavy metals and radionuclides. Climate and Earth System Modeling focuses on development, evaluation, and use of large scale climate change models to determine the impacts, and possible mitigation, of climate change. Two scientific user facilities—the Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) and the Environmental Molecular Sciences Laboratory (EMSL)—provide the broad scientific community with technical capabilities, scientific expertise, and unique information to facilitate science in areas of importance to DOE.

Selected FY 2009 Accomplishments

- In 2009, the ACRF hosted approximately 1,200 users, resulting in over 185 publications in the scientific literature. ACRF completed experiments in several climatically important regions including at the fixed sites (mid-continental U.S, Tropical Western Pacific, and the North Slope of Alaska) and by mobile facilities deployed at Graciosa Island in the Azores, a mountain top in Chile, and in China. Several strong collaborations with other agencies and countries were developed for the conduct of these experiments. These peer reviewed experiments addressed critical science questions including carbon cycling, marine clouds, low-altitude liquid-water clouds, and climatic effects of aerosols.

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[a] Associated FY 2009 funding of $271,488,000 is included in the Biological Research ($98,465,000) and Climate Change Research ($173,023,000) subprograms.

- DOE scientists found that statistics for cloud radiative impacts are almost the same for low-level clouds whether cloud-radiative interactions are represented by one-dimensional or three-dimensional approaches. This result resolves a longstanding question, demonstrating that the simplified approach taken by state-of-the-art global climate models (GCMs) provides a realistic representation of low-level cloud properties. This is an important and useful result as climate models continue to increase in complexity and computational intensity
- Genome-scale models of microbial metabolism have been coupled with reactive transport models to better describe biogeochemical processes affecting uranium transport in groundwater. In a groundbreaking effort, BER investigators have integrated genome science with environmental science to provide a mechanistic basis on which to build a predictive understanding of environmentally relevant microbial processes influencing contaminant transport.
- The Environmental Molecular Sciences Laboratory (EMSL) enabled a multidisciplinary team of scientists to combine mass spectrometry capabilities and the computational chemistry software, NWChem, running on the EMSL supercomputer for molecular simulations to demonstrate that a very short segment of a protein fragment in the membrane of a microorganism is all that binds the microbe to a mineral surface. This finding enables scientists to understand how microbial interactions influence geochemical processes important for bioremediation.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Atmospheric System Research	**0**	**26,452**	**28,396**

The emphasis for Atmospheric System Research is on understanding the radiation balance from the surface of the Earth to the top of the atmosphere and how this balance is affected by clouds, aerosols, and increases in the concentration of greenhouse gases in the atmosphere. In the presence of clouds and aerosols, the current state of radiative transfer modeling is inaccurate, limiting our ability to predict future climates with a high degree of confidence.

The Intergovernmental Panel on Climate Change (IPCC) fourth assessment report establishes that cloud simulation is poor in all climate models. With regard to aerosols, the problem is more severe; we are less sure of the magnitude of its forcing on the climate. Supported research seeks to increase the fidelity of process representations (and interactions among processes) that are needed inputs to the development of the next-generation of climate models, both in the U.S. and internationally. In FY 2011, research will continue to focus on improving the understanding of the relationship of clouds and radiative transfer processes in the atmosphere and the characterization of aerosol physical, chemical, and optical properties and their effects on the Earth's energy balance. Specific focus areas include life cycle of marine boundary layer clouds and their impacts on radiation; aerosol-cloud-precipitation interactions; polar clouds and their interactions with aerosols; high altitude clouds (cirrus) and their life cycles and impacts on radiation budget; and processes and atmospheric transformations involving biogenic aerosols. Analyses will continue on recent campaigns in the Azores, Alaska, Chile, and California. Research will use atmospheric measurements from laboratories, ACRF, and other sources in this effort. Research also will be coordinated with BER's Earth System Modeling activity to quickly and effectively incorporate results into climate models. In FY 2011, increased funding will use data from the new Recovery Act-funded instruments at the ARM sites to support expanded research, specifically the development of three-dimensional representation of clouds in the climate models.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

FY 2009 funding of $15,079,000 and $10,334,000 was in Atmospheric Radiation Measurement (ARM) Research and Atmospheric Science in the Climate Change Research subprogram.

Environmental System Science	**0**	**82,558**	**81,531**
▪ **Terrestrial Ecosystem Science**	**0**	**27,913**	**28,633**

The Terrestrial Ecosystem Science activity advances the fundamental science concerning the effects of climate change on terrestrial ecosystems and the role of terrestrial ecosystems in global carbon cycling. The research focuses on determining the effects of climate change on the structure and functioning of terrestrial ecosystems, understanding the processes controlling exchange rate of carbon dioxide between atmosphere and terrestrial biosphere, and improving reliability of global carbon cycle models for predicting future atmospheric concentrations of carbon dioxide.

Although climate change is expected to cause changes in many terrestrial ecosystems, present correlations between climate and ecosystems do not provide the requisite cause-and-effect understanding needed to forecast effects of future climate changes on terrestrial ecosystems. Experiments involving controlled manipulations of climate factors, and atmospheric carbon dioxide (CO_2) concentration, are needed to establish cause-and-effect relationships between climate changes and effects on ecosystems. While a significant fraction of the CO_2 released to the atmosphere during fossil fuel combustion is apparently now being taken up by terrestrial ecosystems, future impacts of the timing and magnitude of climate change, particularly warming, on the uptake of CO_2 by the terrestrial biosphere remains a mystery. The significant sensitivity of climate models to a terrestrial carbon cycle feedback, and the uncertain sign of that feedback, makes resolving the role of the terrestrial biosphere in the global carbon cycle a high priority.

In FY 2011, the activity will continue ongoing research and initiate new research to understand important potential effects of climate change and increasing atmospheric CO_2 concentration on terrestrial ecosystems and the terrestrial carbon cycle. Continuing research will support AmeriFlux, the network of CO_2 flux measurement sites, for directly estimating net ecosystem production and carbon storage by terrestrial ecosystems. Continuing research on data analysis and model development will support the activity goals. The new activities will include, as recommended by a BERAC subcommittee and a subsequent workshop, continuing development of a next-generation ecosystem-climate change experiment, with a focus on an ecosystem that is of importance at the regional or global scales, is expected to be sensitive to climate change, and has been poorly studied to date. The increased funding will support the development of the novel experimental framework needed to conduct this research.

FY 2009 funding of $13,979,000 and $13,962,000 was in Ecosystem Function and Response, and Terrestrial Carbon Processes within the Climate Change Research subprogram.

▪ **Terrestrial Carbon Sequestration Research**	**0**	**4,747**	**3,000**

Terrestrial Carbon Sequestration research supports efforts to identify, understand, and predict the fundamental physical, chemical, biological, and genetic mechanisms controlling carbon sequestration in terrestrial ecosystems including soils. These challenges are addressed by identifying the physical, biological, and chemical processes controlling soil carbon input, distribution, and longevity; developing models of these systems to predict future scenarios and to inform larger-scale

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

coupled earth systems models; and seeking ways to exploit these processes to enhance carbon sequestration in terrestrial ecosystems. Current research focuses on switchgrass (*Panicum virgatum*) ecosystems associated with DOE's cellulosic ethanol research. Preliminary results indicate that switchgrass' extensive rooting system could be managed for enhanced soil carbon sequestration.

In FY 2011, the focus of this program will be to complete the research objectives of the current field research with an emphasis on the synthesis of data and knowledge collected over the history of the program. Funding is reduced with the completion of a series of research projects focused on the cycling of carbon associated with agriculture and forestry.

FY 2009 funding of $5,104,000 was in the Climate Change Research subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Subsurface Biogeochemical Research**	**0**	**49,898**	**49,898**

The Subsurface Biogeochemical Research activity addresses fundamental science questions at the intersection of biology, geochemistry, and physics to describe complex processes in key subsurface environments. The activity builds on BER advances in genome science and promotes cross-disciplinary research to link interdependent relationships between microbial metabolism, geochemical reactions, and physical transport processes with computational modeling to advance a predictive understanding of environmental processes. The current focus of the activity is to predict the impact of biogeochemical processes on the fate and transport of contaminants in the subsurface. This activity supports research at many scales and includes field research sites at Oak Ridge, Tennessee; Hanford, Washington; and Rifle, Colorado (a uranium mill tailings site). These field sites provide researchers opportunities to obtain samples of environmental media from DOE sites for further evaluation in the laboratory and to test laboratory-derived hypotheses regarding subsurface biogeochemical transport at the field scale. These field sites also are important for testing and evaluating computer models that describe contaminant mobility in the environment. Strong ties have been developed between the Environmental Molecular Sciences Laboratory and subsurface biogeochemical researchers. This activity includes support for SciDAC research on advanced models to predict the mobility of subsurface contaminants.

This fundamental research provides the scientific foundation for the solution of key environmental challenges within DOE and other agencies. These challenges include nuclear waste cleanup, carbon sequestration, and monitoring of contaminants in groundwater around existing and future radionuclide waste disposal and storage sites. These efforts also will assist the Department's research on using deep geological formations to store carbon dioxide taken from the atmosphere.

In FY 2011, the activity will adopt a complex systems approach to environmental research. The approach builds on the findings of a recent workshop and frames the current scope of environmental research across scales as a broad continuum of complex interdependent processes. The approach relies on integrated, multi-disciplinary, multi-scale research efforts to advance a predictive understanding of processes controlling the mobility of radionuclides in the environment. This activity advances innovative scientific approaches to understanding environmental systems providing the basis for DOE's strategic goals for cleanup of legacy nuclear wastes and nuclear energy applications.

FY 2009 funding of $48,702,000 was in Environmental Remediation Sciences Research within the Biological Research subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Climate and Earth System Modeling	**0**	**69,775**	**85,622**
▪ **Regional and Global Climate Modeling**	**0**	**27,856**	**34,351**

Regional and Global Climate Modeling focuses on the research application of regional and global climate models to develop climate change projections on temporal scales of decades to centuries and spatial scales from regional to global. Core research areas are climate model diagnosis and intercomparison through the use of appropriate metrics, detection and attribution of climate change, analysis of multi-model climate change simulations and projections, and understanding of natural and forced variability of the climate system.

Regional and Global Climate Modeling supports the basic research needed to achieve the goals of the core areas and support for national and international climate modeling research and assessments. Currently gaps exist in our knowledge of how modes of climate variability (e.g., the El Niño Southern Oscillation, Pacific Decadal Oscillation, and Northern Annular Mode) change as atmospheric greenhouse gas concentrations continue to increase.

In FY 2011, the focus will be on improving the accuracy of climate predictions at higher resolution. The results of a new set of coordinated experiments from about 20 modeling groups world-wide will be available as part of the Climate Model Intercomparison Project (CMIP5) archive. These model simulations will facilitate the continued development and improvement of the diagnostic tools and metrics used to evaluate the reliability of climate change projections and the multiscale natural modes of variability. Studies on understanding climate extremes, reducing the uncertainty in model predictions, and detection and attribution, and using the newly developed models will continue, as well as efforts to understand feedback processes—such as high latitude ocean-ice interaction and carbon cycle feedbacks—that are important for understanding climate change. The funding increases will provide for enhanced efforts to better represent the feedbacks produced by the indirect effect of aerosols and enhanced efforts in uncertainty quantification for climate model simulations and predictions. Current models have an unacceptably large range of uncertainty, due to differences in the simulation of feedbacks and insufficient information to properly constrain model parameters. Advanced methods coupled with leadership computing resources and integrated observational data sets can reduce these uncertainties.

FY 2009 funding of $34,820,000 was in Climate Change Modeling within Climate Change Research subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Earth System Modeling**	**0**	**30,596**	**39,611**

Earth System Modeling develops the components and the mechanisms needed to couple atmosphere-ocean-land-sea ice models for simulating climate variability and change over decadal to centennial time scales, and thus provides the research results that underpin the Regional and Global Climate Modeling research activities. Research focuses on the incorporation of improved physical presentations in the specific modules of the coupled model. The focus is on incorporation and testing of various schemes for aerosol, convection, ice sheets, and land surface in the coupled models, and evaluation using innovative metrics that span a variety of climate time scales. Research to increase model resolution and computational performance is also conducted. The latter effort is closely coordinated with BER's SciDAC Climate Change Research activities and enhances BER's partnerships with the Advanced Scientific Computing Research program. This partnership

(dollars in thousands)

FY 2009	FY 2010	FY 2011

specifically addresses scaling and other computational issues, so that needed high throughput is achieved. The Earth System Modeling research has been informed by workshops attended by national and international modeling experts.

During the past decade, considerable advances have been made in the detection, understanding, and attribution of past climate change and in projecting future changes in climate using state-of-the-art climate models. However, uncertainties due to climate forcings and feedbacks have not yet been resolved; for example, current coupled atmosphere-ocean-land-sea ice models still have systematic precipitation biases. Improvements are needed before models can accurately simulate regional climate variability and change.

In FY 2011, the focus will be to continue the development of a comprehensive coupled earth system model at high resolution that will be the foundation for understanding climate change at regional and global scales. Improvement of the representation of the physical, chemical, and biogeochemical processes crucial for climate change prediction, such as cloud-aerosol and carbon cycle-climate, are an important part of this program. Development and testing of these processes and their incorporation into high resolution models will continue as part of this program. The program also continues development of software tools that enhance the ability to analyze high resolution model output and observational data in a single framework. This modeling program will also continue its support of Data Visualization which was initiated in 2010. FY 2008 multiyear research awards on abrupt climate change have been completed and no FY 2011 funding is required. In FY 2011, the funding increase will support three activities. First, enhanced research will focus on converting observational datasets into specialized, multi-variable datasets for model testing and improvement. This will seamlessly link and provide integration of existing and new data resources for the purpose of model development and evaluation and advancement. In addition, the increased funding supports establishment of model development testbeds in which model components can be rapidly prototyped and evaluated using integrated observational datasets, like those described above. Thirdly, the enhanced funding will also focus on the development of numerical methods to enable climate models to effectively use future computer architectures.

FY 2009 funding of $26,258,000 was in Climate Change Modeling within Climate Change Research subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Integrated Assessment**	**0**	**11,323**	**11,660**

Integrated Assessment research provides scientific insights into options for mitigation of an adaptation to climate change through multi-scale models of the entire climate system, including human processes responsible for greenhouse gas emissions, land use, and combined impacts on and feedbacks from changing human and natural systems, including the energy system. Importantly, Integrated Assessment research develops advanced quantitative tools for exploring the implications of science and technology decisions and innovations on our energy, environmental, and economic futures.

(dollars in thousands)			
	FY 2009	FY 2010	FY 2011

Research focuses on improving the fundamental knowledge and methodologies for analysis of climate change impacts and adaptations within integrated assessment frameworks; innovative general approaches to modeling impacts and adaptation; developing different measures of impacts; and developing approaches to addressing probabilities and uncertainties. Understanding the role of present and possible future energy technologies remains a central focus of the research, leading to improved understanding of potential emissions trajectories and the environmental costs and benefits of stabilization options.

In FY 2011, BER will continue research on several key research challenges identified in the Integrated Assessment Research Workshop held in November of 2008. In particular, Integrated Assessment will continue to provide the scientifically rigorous, quantitative basis from which policy makers and researchers may assess the impacts of the Nation's scientific and engineering enterprise, improve their understanding of its dynamics, and assess likely outcomes for decision-making on our climate, energy, economic futures. The Integrated Assessment activity will continue to benefit from Recovery Act investments made in FY 2009 that provided the resources to develop open source, community-based approaches to modeling; improve capacity to conduct inter-model comparisons and multi-model studies; improve capacity to enhance convergence of models and collaborations across the Integrated Assessment, Earth System Modeling, and Impacts, Adaptation, and Vulnerability research communities, especially for regional-scale and multi-scale questions; and enhance transparency and accessibility for both data and models by the Integrated Assessment research community, their collaborators, and other user communities. Funding for this activity was increased significantly in FY 2010 to take full advantage of Recovery Act investments. The Recovery Act investments included software upgrade and development as well as short-term efforts to integrate the Recovery Act computing resources into the Integrated Assessment activity.

FY 2009 funding of $9,713,000 was in Integrated Assessment within Climate Change Research subprogram.

	FY 2009	FY 2010	FY 2011
Climate and Environmental Facilities and Infrastructure	**0**	**99,479**	**101,333**
▪ **Atmospheric Radiation Measurement Climate Research Facility**	**0**	**41,809**	**45,770**

The Atmospheric Radiation Measurement Climate Research Facility (ACRF) is a multi-platform national scientific user facility, with stationary and mobile platforms and instruments at fixed and varying locations around the globe. ACRF provides continuous field measurements of climate data to promote the advancement of atmospheric process understanding and climate models through precise observations of atmospheric phenomena. The stationary sites provide scientific testbeds in three different climate regions (mid-latitude, polar, and tropical); the operating paradigm of continuous measurement of atmospheric and surface properties at long-term sites is well suited to climate studies. The two mobile facilities provide a capability to address high priority scientific questions in other regions. The ACRF aerial capability provides *in situ* cloud and radiation measurements that complement the ground-based measurements.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

ACRF provides unparalleled continuous, long-term observations needed to develop and test understanding of the central role of clouds in the Earth's climate and to determine the effects of aerosol emissions on the atmospheric radiation balance. The role of clouds and the effects of aerosols are the two largest uncertainties in climate change research.

In FY 2011, ACRF will continue its long-term observations from the fixed sites and will provide data from the new instruments acquired under the Recovery Act funding. These new data include 3-D cloud evolution and properties, a broader geographic coverage of aerosol measurements, and enhanced surface characterization measurements. ACRF will conduct field experiments to study questions on aerosols and various cloud types—cirrus, marine, and mixed-phase (ice and water)—to improve process understanding as well improving regional and Earth System Models that simulate climate change. The first mobile facility will support an experiment in India to examine the impact of aerosols on the Indian monsoon. The second mobile facility will continue to examine liquid and mixed-phase clouds in Colorado. These measurements support research efforts designed to address the largest uncertainties in the climate models. ACRF will support a field experiment at the North Slope of Alaska site to study cloud and aerosol properties in the Arctic lower troposphere. The increased funding in FY 2011 will support operations of the new Recovery Act instruments resulting in new capabilities for users and new data for improving representation of clouds and aerosols in the climate models.

FY 2009 funding of $40,339,000 was in Atmospheric Radiation Measurement (ARM) Infrastructure within the Climate Change Research subprogram.

		(estimated)	
	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	8,219	N/A	N/A
Planned Operating Hours	7,884	7,884	7,884
Optimal hours	7,884	7,884	7,884
Percent of Optimal Hours	104%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[a]	1,186	1,000	1,000

	FY 2009	FY 2010	FY 2011
▪ **Environmental Molecular Sciences Laboratory**	**0**	**52,021**	**51,340**

The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), a scientific user facility located at the Pacific Northwest National Laboratory, provides integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences for DOE and the Nation. With more than fifty leading-edge instruments and a supercomputer, EMSL enables users to undertake molecular-scale experimental and theoretical

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[a] ARM users are both onsite and remote. A user is an individual who accesses ARM databases or uses equipment at an ARM site. Individuals are only counted once per year at an individual site but may be counted at different ARM sites if they are a user at more than one site.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

research on aerosol chemistry, biological systems, biogeochemistry, and interfacial and surface science.

EMSL encourages the use of multiple experimental systems to provide fundamental understanding of the physical, chemical, and biological processes that underlie DOE's energy and environmental mission areas, including alternative energy sources, improved catalysts and materials for industrial applications, insights into the factors influencing climate change and carbon sequestration processes, and an understanding of subsurface biogeochemistry at contaminated sites. For example, EMSL's nuclear magnetic resonance spectrometers; high resolution mass spectrometers; ultra-high vacuum scanning, tunneling, cryogenic and atomic force microscopy capabilities; and the 160 teraflop supercomputer are all used to study microbial and plant species important for bioenergy and other energy sources. The EMSL capability for proteomics is unique and essential for advances in the field of systems biology.

In FY 2011, EMSL operations funding is increased to provide users with enhanced access to new EMSL capabilities obtained with the FY 2009 Recovery Act funding. Capital equipment support for EMSL enables instrument upgrades and modifications as well as the development and procurement of unique state-of-the-art capabilities needed by external users and EMSL staff to conduct innovative and leading-edge science. A multi-year effort to acquire a High Magnetic Field Mass Spectrometer, a major item of equipment with a total estimated cost of $17,500,000 was initiated in FY 2010 at $ 3,000,000 and is continued in FY 2011 at $7,250,000. This transformational instrument will enable users to undertake world-leading proteomics, metabolomics and lipidomics of plant, animal and microbial cells, communities and other complex systems that will have application to biofuels, systems biology, bioremediation, aerosol particle characterization, catalysis and fossil fuel analysis. A suite of integrated imaging capabilities (advanced data processing, image correlation, and remote operational capabilities) will be developed to better understand biological transformations and energy and materials transport in complex environments and to support systems biology research, particularly proteomics.

FY 2009 funding of $48,953,000 was in the EMSL activity within the Biological Research subprogram.

(estimated)

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	4,376	N/A	N/A
Planned Operating Hours	4,365	4,352	4,365
Optimal hours	4,365	4,365	4,365
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[a]	750	750	750

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[a] EMSL users are both onsite and remote. Individual users are counted once per year.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Data Management and Education	**0**	**4,199**	**2,773**

The role of climate data management is to facilitate full and open access to quality-assured carbon cycle data for climate change research. Data holdings include records of the concentrations of atmospheric CO_2 and other greenhouse gases; the role of the terrestrial biosphere and the oceans in biogeochemical cycles of greenhouse gases; emissions of CO_2 to the atmosphere; long-term climate trends; the effects of elevated CO_2 on vegetation; and the vulnerability of coastal areas to rising sea level. Data management support for major projects, such as the AmeriFlux network, measurements of CO_2 taken aboard ocean research vessels, and DOE-supported Free-Air CO_2 Enrichment (FACE) experiments, are also included.

BER's Global Climate Education Program (GCEP) is completed in FY 2010. BER will meet the outyear commitments for prior year awards. This program has achieved its goals of supporting graduate and undergraduate students with interest in climate change. BER will continue to support students with interest in climate change science through its on-going research at universities and DOE national laboratories. The Office of Science Graduate Fellowship program initiated in FY 2010 within the Workforce Development for Teachers and Scientists (WDTS) program supports graduate students pursuing advanced degrees in areas of research supported by the Office of Science, including climate change research. Likewise the Summer Undergraduate Laboratory Internship program supported by WDTS continues to support undergraduate research opportunities at the national laboratories in areas including climate science.

In FY 2011, the data management activity will continue to support data users with tools for identifying and accessing those data needed to address important climate change research questions. The activity will also implement information technology advances to meet evolving data sharing needs of researchers. These include user interfaces, visualization capabilities, and customized data extractions from large, often complex, data files.

FY 2009 funding of $2,013,000 and $1,422,000 was in Information and Integration, and Education within the Climate Change Research subprogram.

General Purpose Equipment (GPE)	**0**	**750**	**750**

GPE funding provides general purpose equipment for Pacific Northwest National Laboratory (PNNL) and Oak Ridge Institute for Science and Education (ORISE), such as information system computers and networks and instrumentation that support multi-purpose research.

FY 2009 funding of $112,000 was in Environmental Remediation Sciences Research activity within the Biological Research subprogram.

General Plant Projects (GPP)	**0**	**700**	**700**

GPP funding supports minor construction, capital alterations, and additions, such as replacing utility systems in 30 to 40 year old buildings. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and meeting the requirements for safe and reliable facilities operation. This activity includes stewardship GPP funding for ORISE. The total estimated cost of each GPP project will not exceed $5,000,000 in FY 2011.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
FY 2009 funding of $698,000 was in Environmental Remediation Sciences Research activity within the Biological Research subprogram.			
SBIR/STTR	**0**	**7,442**	**8,071**
FY 2010 and FY 2011 amounts shown for the SBIR and STTR programs are the estimated requirements for continuation of these congressionally mandated programs.			
Total, Climate and Environmental Sciences	**0**	**285,706**	**304,953**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Atmospheric System Research	
The increased funding will support the development of the next generation 3D cloud parameterizations.	**+1,944**
Environmental System Science	
▪ **Terrestrial Ecosystem Science**	
The increased funding will support development of the next-generation of large-scale, long-term manipulative field experiments, with a focus on an ecosystem that has to date been poorly studied, is expected to be sensitive to climate change, and is of significant importance at the regional or global scales.	+720
▪ **Terrestrial Carbon Sequestration Research**	
Funding is reduced with the completion of a series of research projects focused on the cycling of carbon sequestration associated with agriculture and forestry.	-1,747
Total, Environmental System Science	**-1,027**
Climate and Earth System Modeling	
▪ **Regional and Global Climate Modeling**	
Funding increases to enhance efforts to better represent the feedbacks produced by the indirect effect of aerosols and enhanced efforts in uncertainty quantification.	+6,495
▪ **Earth System Modeling**	
Funding increases to support focused efforts for converting observational datasets, the establishment of model development testbeds, and new numerical capabilities for transitioning climate models to new computing architectures.	+9,015

	FY 2011 vs. FY 2010 ($000)
▪ **Integrated Assessment**	
In FY 2011 Integrated Assessment will continue to provide the scientifically rigorous, quantitative basis from which policy makers and researchers may assess the impacts of the Nation's scientific and engineering enterprise, improve their understanding of its dynamics, and assess likely outcomes for decision-making on our climate, energy, economic futures.	+337
Total, Climate and Earth System Modeling	**+15,847**
Climate and Environmental Facilities and Infrastructure	
▪ **ARM Climate Research Facility**	
The increase will support operations of the new Recovery Act instruments resulting in new capabilities for users and new data for improving representation of clouds and aerosols in the climate models.	+3,961
▪ **Environmental Molecular Sciences Laboratory**	
Funding is held near FY 2010 levels. Operations funding increases are offset by reductions in capital equipment funding.	-681
▪ **Data Management and Education**	
Support for BER's Global Climate Education Program is completed in FY 2010. The Workforce Development for Teachers and Scientists program will support graduate climate science education in the DOE Office of Science Graduate Fellowship program.	-1,426
Total, Climate and Environmental Facilities and Infrastructure	**+1,854**
SBIR/STTR	
SBIR/STTR increases as the funding for research increases.	+629
Total Funding Change, Climate and Environmental Sciences	**+19,247**

Biological Research

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Biological Research			
Life Sciences	305,462	0	0
Medical Applications	8,226	0	0
Environmental Remediation	98,465	0	0
Total, Biological Research	412,153[a]	0	0

Description

The BER program has continued its investments in core fundamental science and technologies needed to address the interfaces between scientific disciplines such as biology, physics, chemistry, engineering, and information science. Within the Biological Research subprogram, the highest priority has been the Genomics: GTL program which develops an understanding of the fundamental principles underlying the function and control of biological systems.

Modifications were made to the budget structure to better reflect the subprogram's activities starting in FY 2010. The Conference report for the FY 2010 Energy and Water Development Appropriations Bill reflected this new structure.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Life Sciences	**305,462**	**0**	**0**
▪ **Structural Biology**	**15,300**	**0**	**0**

The Structural Biology program develops and supports access to beamlines and instrumentation at DOE's national user facilities for the Nation's structural biologists. BER coordinates, with the NIH and the NSF, the management and maintenance of 22 experimental stations at several DOE synchrotrons (Advanced Photon Source [APS], Advanced Light Source [ALS], and Stanford Synchrotron Radiation Laboratory [SSRL]).

In FY 2010 and 2011, funding is shown in the Biological Systems Facilities and Infrastructure activity in the Biological Systems Science subprogram.

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[a] $313,688,000 is associated with activities funded in the Biological Systems Science subprogram in FY 2010 and FY 2011, and $98,465,000 with activities funded in the Climate and Environmental Science subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **Molecular and Cellular Biology**	**191,391**	**0**	**0**
• **Carbon Sequestration Research**	**7,817**	**0**	**0**

Carbon sequestration research seeks to understand the fundamental mechanisms of carbon fixation, conversion and cycling in microbes, microbial communities, and plants. The program initiated a new focus on carbon sequestration and utilization for biofuels, with genomics-based research that will lead to the improved use of plant feedstocks for the production of carbon-neutral fuels such as ethanol or renewable chemical feedstocks.

In FY 2010 and 2011, funding is shown in the Metabolic Synthesis and Conversion activity in the Biological Systems Science subprogram.

• **Genomics: GTL**	**162,847**	**0**	**0**
▸ **Genomics: GTL Foundational Research**	**41,850**	**0**	**0**

The Foundational Research activity supports fundamental research and technology development that underpins all microbial and plant research conducted in the Genomics: GTL program overall and in the GTL Bioenergy Research Centers. GTL Foundational Research also develops the robust computational infrastructure needed to understand, predict, and ultimately use the genomic potential, cellular responses, biological regulation, and behaviors of complex biological systems of interest to the DOE mission.

In FY 2010 and 2011, funding is shown in the Foundational Genomics Research and Computational Biosciences activities in the Biological Systems Science subprogram.

▸ **Genomics: GTL Sequencing**	**10,000**	**0**	**0**

DNA sequence data underpins and is the starting point for all aspects of the Genomics: GTL program. The vast majority of high-throughput DNA sequencing of plants, microbes, and microbial communities conducted at the Joint Genome Institute (JGI) user facility is directly relevant to the Genomics: GTL program. Research continued within Genomics: GTL to generate DNA sequence data of individual genes as they are expressed, whole genomes, and metagenomes in order to provide essential information needed to formulate genetic engineering strategies for microbes and plants, to understand plant and microbe molecular machines, to determine the composition of complex microbial communities, and to dissect plant-microbe associations.

In FY 2010 and 2011, funding is shown in the Genomics Analysis and Validation activity in the Biological Systems Science subprogram.

▸ **Genomics: GTL Biohydrogen Research**	**15,661**	**0**	**0**

This activity supports innovative systems biology research with a specific emphasis on biological hydrogen production, such as the discovery and development of improved or oxygen-tolerant hydrogenases, characterization of specific cellular architecture to facilitate electron transfer for optimum hydrogen production, and the redirection of metabolic

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

pathways and metabolite flow into hydrogen production. While this activity draws upon the foundational research and technology development within the broader GTL portfolio, it is specifically directed towards scientific issues and challenges unique to biological hydrogen production.

In FY 2010 and 2011, funding is shown in the Metabolic Synthesis and Conversion activity in the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
▶ **Genomics: GTL Bioethanol Research**	**20,336**	**0**	**0**

Cellulosic ethanol is a carbon-neutral fuel that can already be used within today's energy infrastructure. Microbes or microbial processes are used to produce ethanol from residues such as corn plants left after a corn harvest or energy crops such as poplar trees that are specifically grown as biomass for energy production. While this activity draws upon the foundational research and technology development within the broader GTL portfolio it is specifically directed towards scientific issues and challenges unique to understanding the metabolic conversion of 5- and 6-carbon sugars to ethanol.

In FY 2010 and 2011, funding is shown in the Metabolic Synthesis and Conversion activity in the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
▶ **Genomics: GTL Bioenergy Research Centers**	**75,000**	**0**	**0**

The three DOE Bioenergy Research Centers, all involving academic, industrial, and national laboratory scientists, are designed to accomplish the GTL program objectives more effectively. The centers serve as catalysts for innovation and change, by concentrating appropriate technologies and scientific expertise to go from the genome sequence to an integrated systems understanding of the pathways and internal structures of plants and microbes most relevant to the steps required to develop bioenergy compounds.

In FY 2010 and 2011, funding is shown in the Bioenergy Research Centers within the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
• **Low Dose Radiation Research**	**20,727**	**0**	**0**

The Low Dose Radiation Research activity supports research that will help determine health risks from exposures to low levels of ionizing radiation; information critical to adequately and appropriately protecting individuals, and to making more effective use of our national resources. Information developed in this program will provide a better scientific basis for making decisions with regard to remediating contaminated DOE sites and for determining acceptable levels of human health protection, both for cleanup workers and the public, in the most cost-effective manner. Some research in this program is jointly funded with NASA's Office of Biological and Physical Research.

In FY 2010 and 2011, funding is shown in the Radiobiology activity in the Biological Systems Science subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ **Human Genome**	**70,000**	**0**	**0**
• **Joint Genome Institute, Production Genomics Facilities**	**55,000**	**0**	**0**

The Joint Genome Institute's (JGI) high-throughput DNA sequencing factory, the Production Genomics Facility (PGF) is focused on helping to meet the demand for DNA sequencing in the broader energy and environment scientific community.

In FY 2010 and 2011, funding is in Joint Genome Institute within the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
• **Tools for DNA Sequencing and Sequence Analysis**	**10,000**	**0**	**0**

BER develops the tools and resources needed by the scientific, medical, and industrial sector communities to fully exploit the information contained in complete DNA sequences, from energy-relevant microbes to low dose radiation effects.

In FY 2010 and 2011, funding is in the Joint Genome Institute activity in the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
• **Ethical, Legal, and Societal Issues (ELSI)**	**5,000**	**0**	**0**

BER ELSI research supports activities applicable to Office of Science issues in bioenergy, synthetic biology, and nanotechnology, including exploration of, and communication of, the societal implications arising from these programs.

In FY 2010 and 2011, funding is in the Ethical, Legal, and Societal Issues (ELSI) activity in the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Health Effects**	**5,937**	**0**	**0**

Health effects research in functional genomics provides a link between human genomic sequencing and the development of information that is useful in understanding normal human development and disease processes including susceptibility to low doses of ionizing radiation.

In FY 2010 and 2011, funding is in the Radiobiology activity in the Biological Systems Science subprogram.

	FY 2009	FY 2010	FY 2011
▪ **Radiochemistry and Instrumentation**	**22,834**	**0**	**0**

BER supports basic research that builds on unique DOE capabilities in physics, chemistry, engineering, and computational science. It supports fundamental imaging research, maintains core infrastructure for imaging research and development, including innovative imaging technology with respect to new radiochemistry and radiotracer methodologies for precise and dynamic metabolic imaging of biological organisms.

In FY 2010 and 2011, funding is in Radiochemistry and Imaging Instrumentation within the Biological Systems Science subprogram.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Medical Applications			
▪ **Artificial Retina**	**8,226**	**0**	**0**

BER utilized the resources of the national laboratories in material sciences, engineering, microfabrication, and microengineering to develop unique neuroprostheses and continue development of an artificial retina to restore sight to the blind.

In FY 2010 and 2011, funding is in the Medical Applications activity within the Biological Systems Science subprogram.

Environmental Remediation	**98,465**	**0**	**0**
▪ **Environmental Remediation Sciences Research**	**48,702**	**0**	**0**

Environmental Remediation Sciences research activities address questions of fundamental environmental remediation science at the interfaces of biology, chemistry, geology, and physics. The research will help to provide the scientific foundation for the solution of key environmental challenges within DOE's cleanup mission at scales ranging from molecular to the field, including issues of fate and transport of contaminants in the environment; novel strategies for *in situ* remediation; and long-term monitoring of remediation strategies.

In FY 2010 and 2011, Environmental Remediation Sciences Research funding is in Subsurface Biogeochemical Research within the Climate and Environmental Sciences subprogram.

▪ **General Purpose Equipment (GPE)**	**112**	**0**	**0**

GPE funding will increase to provide general purpose equipment for Pacific Northwest National Laboratory (PNNL) and Oak Ridge Institute for Science and Education (ORISE) such as information system computers and networks, and instrumentation that support multi-purpose research.

In FY 2010 and 2011, GPE funding is in Climate and Environmental Facilities and Infrastructure within the Climate and Environmental Sciences subprogram

▪ **General Plant Projects (GPP)**	**698**	**0**	**0**

GPP funding continued for minor new construction, other capital alterations and additions, and for buildings and utility systems, such as replacing infrastructure in 30- to 40-year old buildings. Funding of this type is essential for maintaining the productivity and usefulness of Department-owned facilities and meeting the requirements for safe and reliable facilities operation. This activity included stewardship GPP funding for ORISE.

In FY 2010 and 2011, GPP funding is in Climate and Environmental Facilities and Infrastructure within the Climate and Environmental Sciences subprogram.

▪ **Facility Operations**	**48,953**	**0**	**0**

The William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), a national scientific user facility located at the Pacific Northwest National Laboratory, provides integrated experimental and computational resources for discovery and technological innovation in the environmental molecular sciences to support the needs of DOE and the Nation.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
EMSL Operating Expenses	**34,223**	**0**	**0**

Operating funds are used for: staff support for users; maintenance of instruments and buildings; utilities; environmental safety and health compliance activities; and communications. With over 55 leading-edge instruments and a supercomputer system, EMSL annually supports approximately 700 users. The core EMSL science team networks with the broader academic community as well as with DOE national laboratories and other agencies. EMSL users have access to unique expertise and instrumentation for environmental research, including a high performance computer; a 900 MHz nuclear magnetic resonance (NMR) spectrometer that highlights a suite of NMRs in EMSL; a collection of mass spectrometers, including an 11.5 Tesla high performance mass spectrometer; laser desorption and ablation instrumentation; ultra-high vacuum scanning, tunneling and atomic force microscopes; and controlled atmosphere environmental chambers.

In FY 2010 and 2011, funding for EMSL Operating Expenses is in EMSL Operations and Infrastructure within the Climate and Environmental Sciences subprogram.

Capital Equipment	**5,987**	**0**	**0**

Capital equipment support for the EMSL enables instrument modifications needed by collaborators and external users of the facility as well as the ability to make upgrades to existing instrumentation and to provide additional capabilities in order to maintain EMSL capabilities for environmental molecular scientific research.

In FY 2010 and 2011, funding for EMSL Capital Equipment is in EMSL Operations and Infrastructure within the Climate and Environmental Sciences subprogram.

EMSL GPP	**8,743**	**0**	**0**

GPP is provided to initiate development and construction of an addition to EMSL.

In FY 2010 and 2011, funding for EMSL GPP is in EMSL Operations and Infrastructure within the Climate and Environmental Sciences subprogram.

Total, Biological Research	**412,153**	**0**	**0**

Climate Change Research

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Climate Change Research			
Climate Forcing	81,727	0	0
Climate Change Modeling	61,078	0	0
Climate Change Response	25,114	0	0
Climate Change Mitigation	5,104	0	0
Total, Climate Change Research	173,023[a]	0	0

Description

BER priorities within the Climate Change Research subprogram are to develop the ability to predict climate on global and regional scales; to explore the impacts of excess atmospheric CO_2 on the Earth system; to develop strategies for its removal and sequestration from the atmosphere; and, provide the science to underpin the prediction of the impacts of climate change. These priorities will depend on the continued development of novel research tools and a close integration of experimental, observational, and computational research.

Modifications were made to the budget structure to better reflect the subprogram's activities starting in FY 2010. The Conference report for the FY 2010 Energy and Water Development Appropriations Bill reflected this new structure.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Climate Forcing	**81,727**	**0**	**0**
▪ **Atmospheric Radiation Measurement (ARM) Research**	**15,079**	**0**	**0**

A major emphasis in the Climate Forcing area of the Climate Change Research subprogram is on understanding the radiation balance from the surface of the Earth to the top of the atmosphere and how this balance is affected by clouds, aerosols, and increases in the concentration of greenhouse gases in the atmosphere.

In FY 2010 and 2011, funding is shown in Atmospheric System Research within the Climate and Environmental Sciences subprogram.

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[a] Associated FY 2010 and 2011 activities are funded in the Climate and Environmental Sciences subprogram.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ **Atmospheric Radiation Measurement (ARM) Infrastructure**	**40,339**	**0**	**0**

The ARM infrastructure activity will continue to support and upgrade the operation of the ARM Climate Research Facility (ACRF). The ACRF consists of three stationary facilities, an ARM Mobile Facility (AMF), and the ARM Aerial Vehicles Program (AAVP). The stationary sites provide scientific testbeds in three different climatic regions (mid-latitude, polar, and tropical); the operating paradigm of continuous measurement of atmospheric and surface properties at long-term sites is well suited to climate studies. The AMF provides a capability to address high priority scientific questions in regions other than the stationary sites. The AAVP provides a capability to obtain *in situ* cloud and radiation measurements that complement the ground-based measurements.

In FY 2010 and 2011, funding is shown in ARM Operations and Infrastructure within the Climate and Environmental Sciences subprogram.

▪ **Atmospheric Science**	**10,334**	**0**	**0**

The Atmospheric Science Program is focused on the radiative effects of atmospheric aerosols, the greatest source of uncertainty in global radiative forcing of climate change over the last century. To enable more reliable and accurate simulations of direct and indirect aerosol climate forcing, the program conducts research on the atmospheric processes that control the formation, transport, transformations, and removal of atmospheric aerosols as these affect their distribution, radiative, and cloud nucleating properties.

In FY 2010 and 2011, funding is shown in the Atmospheric System Research activity within the Climate and Environmental Sciences subprogram.

▪ **Terrestrial Carbon Processes**	**13,962**	**0**	**0**

BER continues support of AmeriFlux, a network of research sites where the net exchange of carbon dioxide, energy, and water between the atmosphere and major terrestrial ecosystems in North America is continuously measured.

The AmeriFlux Network research sites provided extensive measurements of terrestrial carbon sink properties, including biological and soil carbon processes. This research is important for evaluating what happens to carbon dioxide emissions from combustion of fossil fuels, and provides scientific information needed for prognostic modeling of the rate of atmospheric carbon dioxide increase, which is a key forcing factor of climate.

In FY 2010 and 2011, funding is shown in Terrestrial Ecosystem Science within the Climate and Environmental Sciences subprogram.

▪ **Information and Integration**	**2,013**	**0**	**0**

The Information and Integration element of Climate Forcing research continued to store, evaluate, quality assure, and disseminate a broad range of climate change related data, especially data on atmospheric concentrations and industrial emissions of greenhouse gases, greenhouse gas fluxes from terrestrial systems, ocean CO_2 data, and air quality data. This is accomplished by supporting the Carbon Dioxide Information and Analysis Center (CDIAC). CDIAC's data holdings include records of the concentrations of carbon dioxide and other radiatively active gases in the atmosphere;

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

the role of the terrestrial biosphere and the oceans in the biogeochemical cycles of greenhouse gases; emissions of carbon dioxide to the atmosphere; long-term climate trends; the effects of elevated carbon dioxide on vegetation; and the vulnerability of coastal areas to rising sea level.

In FY 2010 and 2011, funding is shown in Data Management and Education within the Climate and Environmental Sciences subprogram.

Climate Change Modeling	**61,078**	**0**	**0**

BER's Climate Change Modeling program addresses uncertainty in simulating Regional and Global Climate Change. The focus is on incorporation and testing of various aerosol schemes, convection schemes, ice sheets, and land surface schemes in the coupled models, and evaluation using innovative metrics that span a variety of climate time scales.

BER's SciDAC for Climate Change Research continued partnerships with the Advanced Scientific Computing Research program.

In FY 2010 and 2011, funding is shown in the Climate and Earth System Modeling activity within the Climate and Environmental Sciences subprogram.

Climate Change Response	**25,114**	**0**	**0**
▪ **Ecosystem Function and Response**	**13,979**	**0**	**0**

The goal of the Ecosystem Function and Response research activity is to understand the potential effects of climatic change anticipated during the coming 50-100 years on the health of important terrestrial ecosystems in the United States. The primary focus is experimental studies of the potential effects of warming on the abundance and geographic distribution of plant and animal species in several ecosystem types. The experiments will be conducted to fill specific critical knowledge gaps. In particular, experiments will determine linkages between warming and the possibility of species migrations, the expansion of species into areas that are presently too cool for their success, and the decline of species or ecosystems presently at the warm edge of their ranges.

In FY 2010 and 2011, funding is shown in Terrestrial Ecosystem Science within the Climate and Environmental Sciences subprogram.

▪ **Integrated Assessment**	**9,713**	**0**	**0**

BER's Integrated Assessment (IA) Research supports underlying research and development of the basic methods and models for estimating costs and benefits of global climate change and possible actions to mitigate such change. Understanding the underlying and complex human-earth systems dynamics are a priority for IA research.

In FY 2010 and 2011, funding is shown in Integrated Assessment within Climate and Earth System Modeling in the Climate and Environmental Sciences subprogram.

▪ **Education**	**1,422**	**0**	**0**

BER's Global Change Education Program continues to support both undergraduate and graduate studies in FY 2009 through the DOE Summer Undergraduate Research Experience (SURE) and the DOE Graduate Research Environmental Fellowships (GREF).

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
In FY 2010 and 2011, funding is shown in Data Management and Education within the Climate and Environmental Sciences subprogram.			
Climate Change Mitigation	**5,104**	**0**	**0**
BER's carbon sequestration research, part of BER's support to the Climate Change Technology Program, continued to focus only on terrestrial carbon sequestration. Research continues on studies to enhance long-term sequestration processes and the stability of stored carbon in terrestrial vegetation and soils.			
In FY 2010 and 2011, funding is shown in Terrestrial Carbon Sequestration Research within the Climate and Environmental Sciences subprogram.			
Total, Climate Change Research	**173,023**	**0**	**0**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Operating Expenses	561,792	576,818	601,786
Capital Equipment	13,943	24,164	24,414
General Plant Projects (GPP)	9,441	3,200	700
Total BER	585,176	604,182	626,900

Funding Summary

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Research	406,031	395,251	419,290
Scientific User Facilities Operations and Research	169,592	178,130	182,060
Major Items of Equipment	0	10,700	7,250
Facility related GPP	8,743	2,500	0
Other[a]	810	17,601	18,300
Total BER	585,176	604,182	626,900

Scientific User Facilities Operations and Research

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Biological Systems Science			
Structural Biology Infrastructure	15,300	15,300	15,683
Joint Genomics Institute	65,000	69,000	69,267
Total, Biological Systems Science	80,300	84,300	84,950
Climate and Environmental Sciences			
Atmospheric Radiation Measurement Climate Research Facility	40,339	41,809	45,770
Environmental Molecular Sciences Laboratory	48,953	52,021	51,340
Total, Climate and Environmental Science	89,292	93,830	97,110
Total Science User Facilities Operations and Research	169,592	178,130	182,060

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[a] Includes SBIR, STTR, GPE, and non-Facility related GPP.

Facilities Users and Hours

	FY 2009	FY 2010	FY 2011
Joint Genome Institute			
Achieved Operating Hours	8,400	N/A	N/A
Planned Operating Hours	8,400	8,400	8,400
Optimal hours	8,400	8,400	8,400
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[a]	780	940	940
Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF)			
Achieved Operating Hours	8,219	N/A	N/A
Planned Operating Hours	7,884	7,884	7,884
Optimal hours	7,884	7,884	7,884
Percent of Optimal Hours	104%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[b]	1,186	1,000	1,000
Environmental Molecular Sciences Laboratory			
Achieved Operating Hours	4,376	N/A	N/A
Planned Operating Hours	4,365	4,352	4,365
Optimal hours	4,365	4,365	4,365
Percent of Optimal Hours	100%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users[c]	750	750	750

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[a] All JGI users are remote. Primary users are individuals associated with approved projects being conducted at the JGI in a reporting period. Each user is counted once per year regardless of how many proposals their name may be associated with. Additionally, different users reflect vastly differing levels of JGI resources

[b] ARM users are both onsite and remote. A user is an individual who accesses ARM databases or uses equipment at an ARM site. Individuals are only counted once per reporting period at an individual site but may be counted at different ARM sites if they are a user at more than one site.

[c] EMSL users are both onsite and remote. Individual users are counted once per year.

	FY 2009	FY 2010	FY 2011
Total Facilities			
Achieved Operating Hours	20,995	N/A	N/A
Planned Operating Hours	20,649	20,636	20,649
Optimal hours	20,649	20,649	20,649
Percent of Optimal Hours	104%	100%	100%
Unscheduled Downtime	0	N/A	N/A
Number of Users	2,716	2,690	2,690

Structural Biology Infrastructure activities are at Basic Energy Sciences user facilities and the user statistics are included in the BES user statistics.

Major Items of Equipment

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF)							
Dual-Frequency Scanning Cloud Radar for Southern Great Plains ARM Site							
Total Estimated Costs (TEC)/ Total Project Costs (TPC)	0	0	3,070	0	0	0	3,070
Dual-Frequency Scanning Cloud Radar for North Slope of Alaska ARM Site							
TEC/TPC	0	0	3,070	0	0	0	3,070
Dual-Frequency Scanning Cloud Radar for Tropical Western Pacific (Manus) ARM Site							
TEC/TPC	0	0	3,070	0	0	0	3,070
Dual-Frequency Scanning Cloud Radar for ARM Mobile Facility #1							
TEC/TPC	0	0	3,070	0	0	0	3,070
Dual-Frequency Scanning Cloud Radar for ARM Mobile Facility #2							
TEC/TPC	0	0	3,070	0	0	0	3,070
Dual-Frequency Scanning Cloud Radar for Tropical Western Pacific (Darwin) ARM Site							
TEC/TPC	0	0	3,070	0	0	0	3,070

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Total ACRF TEC/TPC	0	0	18,420	0	0	0	18,420
Environmental Molecular Sciences Laboratory (EMSL)							
Field Emission-Transmission Electron Microscope (FE-TEM)							
TEC/TPC	4,500	0	0	0	0	0	4,500
Standard Transmission Electron Microscope (TEM)							
TEC/TPC	0	0	2,940	0	0	0	2,940
X-ray Phototelectron Spectrometer (XPS)							
TEC/TPC	0	0	2,027	0	0	0	2,027
3-D Atom Probe							
TEC/TPC	0	0	2,280	0	0	0	2,280
Electron Microprobe							
TEC/TPC	0	0	2,250	0	0	0	2,250
700 Megahertz Wide Bore Nuclear Magnetic Resonance (NMR) Spectrometer							
TEC/TPC	0	0	2,640	0	0	0	2,640
15 Tesla Fourier Transform-Ion Cyclotron Resonance (FT-ICR) Mass Spectrometer (MS)							
TEC/TPC	0	0	2,840	0	0	0	2,840
Ultra-High Vacuum (UHV) Scanning Tunneling Microscope/Atomic Force Microscope (STM/AFM)							
TEC/TPC	0	0	2,200	0	0	0	2,200
850 Megahertz Wide Bore Nuclear Magnetic Resonance (NMR) Spectrometer							
TEC/TPC	0	0	4,830	0	0	0	4,830
3-D Microscope System							
TEC/TPC	0	0	2,250	0	0	0	2,250

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Advanced Mass Spectrometry System							
TEC/TPC	0	0	2,900	0	0	0	2,900
Advanced Oxygen Plasma Assisted Molecular Beam Epitaxy system							
TEC/TPC	0	0	0	3,200	0	0	3,200
Secondary Ion Mass Spectrometer							
TEC/TPC	0	0	0	4,500	0	0	4,500
Next Generation, High Magnetic Field Mass Spectrometer							
TEC/TPC	0	0	0	3,000	7,250	7,250	17,500
Total EMSL TEC/TPC	4,500	0	27,157	10,700	7,250	7,250	56,857
Total BER TEC/TPC	4,500	0	45,577	10,700	7,250	7,250	75,277

Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF)

Dual-frequency scanning cloud radar for the Southern Great Plains ARM Site. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties at the Southern Great Plains ARM Site. These data are essential for developing high-resolution climate models.

Dual-frequency scanning cloud radar for the North Slope of Alaska ARM Site. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties at the North Slope of Alaska ARM Site. These data are essential for developing high-resolution climate models.

Dual-frequency scanning cloud radar for the Tropical Western Pacific (Manus) ARM Site. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties at the Tropical Western Pacific (Manus) ARM Site. These data are essential for developing high-resolution climate models.

Dual-frequency scanning cloud radar for the ARM Mobile Facility #1. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties for the ARM Mobile Facility #1. These data are essential for developing high-resolution climate models.

Dual-frequency scanning cloud radar for the ARM Mobile Facility #2. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties for the ARM Mobile Facility #2. These data are essential for developing high-resolution climate models.

Dual-frequency scanning cloud radar for the Tropical Western Pacific (Darwin) ARM Site. This instrument will provide the capability to measure cloud properties in a volume and will provide three-dimensional cloud properties at Tropical Western Pacific (Darwin) ARM Site. These data are essential for developing high-resolution climate models.

Environmental Molecular Sciences Laboratory

Field Emission-Transmission Electron Microscope (FE-TEM) will allow imaging of reactions at the atomic scale under high temperature and pressure conditions. This understanding will be key to assess the reactivity of novel materials for use in hydrogen fuel cells and for examining the conversion of organic matter into alternative fuels.

Standard Transmission Electron Microscope (TEM) to enable nano-meter structural and chemical characterization of complex synthesized and natural materials relevant to catalysis, fuel cells, energy storage and sensing.

X-ray Photoelectron Spectrometer (XPS) will enable three dimensional chemical maps of the outer 50 nanometers of natural materials as well as designed or degraded functionalized materials. The XPS will be used to study mineral/contaminant interactions, aging and degradation of solar cells and solid state lighting and catalytic surfaces.

3-D Atom Probe for three dimensional atomic scale imaging of complex materials including solid-solid "buried" interfaces. This system will be used for material surface studies relevant to subsurface remediation, photovoltaics and catalysis.

Electron Microprobe provides elemental composition and structural imaging of materials/minerals. This capability has relevance to radiological applications such as waste storage and processing.

700 Megahertz Wide Bore Nuclear Magnetic Resonance (NMR) Spectrometer system is used to perform solid-state and liquids NMR measurements of radiological-containing and radiologically-exposed materials.

15 Tesla Fourier Transform Ion Cyclotron Resonance (FT-ICR) Mass Spectrometer to replace EMSL's original 11.5 Tesla system. This capability will enable the study of intact and modified proteins, and will fundamentally advance biological science insights for microbial and plant systems.

Ultra-High Vacuum (UHV) Scanning Tunneling Microscope/Atomic Force Microscope (STM/AFM) will enable site-specific chemical measurements with unique abilities to control the arrival of molecules at the site. This system will be used for research on catalysts for fuel cell operation, contaminant destruction and energy production.

850 Megahertz Wide Bore Nuclear Magnetic Resonance (NMR) Spectrometer will be optimized for solid-state investigation of materials and metallic systems and will be used to study energy-relevant materials (including catalysts) and minerals and contaminants.

3-D Microscope System will provide Transmission Electron Microscope-like resolution of bulk samples and will provide new 3D information on aerosol particles, microbial/mineral interfaces, catalytic surfaces and other materials.

Advanced Mass Spectrometry System with liquid chromatography capability for the identification and quantification of peptides and proteins to aid in studies of microbial communities and plant systems.

Advanced Oxygen Plasma Assisted Molecular Beam Epitaxy system is designed for the growth of a wide variety of oxide materials and will be funded at $3,200,000 TEC in FY 2010 and delivered in FY 2011.

This instrument will enable synthesis and characterization of oxide films and surfaces important for catalysis, electronic and spintronic materials, and geochemistry.

Secondary Ion Mass Spectrometer will be used for high spatial resolution as well as trace element and isotopic analysis of ultra-fine features and will be funded at $4,500,000 TEC in FY 2010 and delivered in FY 2011. This instrument will provide extremely high resolution of organic and inorganic samples applicable to geochemistry, aerosol particles and materials.

Next Generation, High Magnetic Field Mass Spectrometer system will be a world-leading system to measure and characterize complex mixtures of intact proteins and other biomolecules, aerosol particles, petroleum, and constituents from other types of fluids. Initially funded at $3,000,000 in FY 2010 with delivery in FY 2014, the TEC will be $17,500,000. The system will enable world-leading proteomics, metabolomics and lipidomics with application to bioenergy, as well as provide insights relevant to climate science, fossil fuel processing, and catalysis.

Scientific Employment

	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
# University Grants	489	475	490
Average Size per year	$320,000	$320,000	$320,000
# Laboratory Projects	377	234[a]	195
# Permanent Ph.D.s[b]	1,480	1,460	1500
# Postdoctoral Associates[c]	340	335	345
# Graduate Students[c]	485	480	495
# Ph.D.s awarded[d]	105	110	110

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[a] In FY 2010, BER consolidated funding for laboratories resulting in fewer individual projects.

[b] Estimated. Information is not readily available on the total number of permanent Ph.D. scientists associated with each research project. In addition to the principal investigator for each research project funded by BER, individual projects typically have between 1 and 20 additional Ph.D.-level scientists who are funded collaborators. Information on scientific collaborators is not routinely tracked.

[c] Estimated for national laboratory projects.

[d] Estimated. Information is not available on the number of Ph.D.s awarded as a result of BER funded research at universities or national laboratories.

Fusion Energy Sciences
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Fusion Energy Sciences				
Science	163,479	+57,399	182,092	185,940
Facility Operations	207,649	+33,624	220,717	170,020
Enabling R&D	23,390	0	23,191	24,040
Total, Fusion Energy Sciences	394,518[b]	+91,023	426,000	380,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The FES mission is to expand the fundamental understanding of matter at very high temperatures and densities and to develop the scientific foundations needed to develop a fusion energy source. This is accomplished by studying plasmas and their interactions with their surroundings under a wide range of temperature and density, developing advanced diagnostics to make detailed measurements of their properties, and creating theoretical and computational models to resolve the essential physics.

Background

The physics of plasmas is at the heart of understanding how stars shine and evolve over billions of years. Plasmas, essentially hot gases of ions and electrons, are found in environments as familiar as fluorescent lighting and lightning bolts, as unimaginably harsh as the centers of stars, and as exotic as the environments surrounding super massive black holes. The science of plasma physics that describes the plasmas in these environments also describes the auroras that gently illuminate the northern and southern skies and the solar corona, where temperatures are far higher than on the sun's surface. At the scale of the very small, plasma physics and materials science combine to enable the exquisitely precise manufacture of semiconductors. Plasma science is also at the heart of advances in efficiencies in the lighting industry.

Plasma science forms the basis for research that is needed to establish our ability to harness the power of the stars in order to generate fusion energy on earth. The successful development of this science and relevant supporting sciences may have enormous implications for the future. The plasma and materials science needed to form the essential understanding required for fusion energy is both rich and far-reaching. The research central to the highest level goals of fusion research—the creation of an energy source with a virtually limitless fuel supply, with low level radioactive waste, and with no carbon emission—has a reach even broader than these ambitious goals suggest. The research required for fusion energy's success is intimately tied to rich scientific questions about some of nature's most extreme environments, inside and outside of stars, and has practical implications to industry beyond energy as well.

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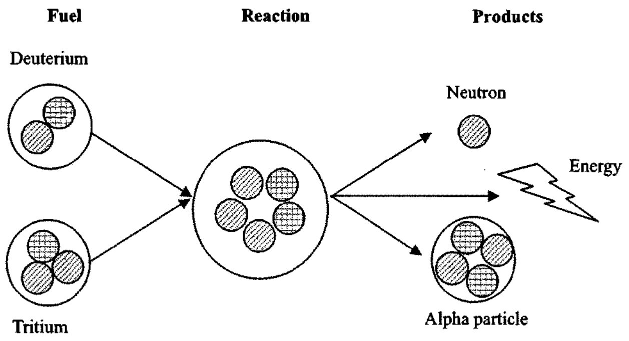
[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.
[b] Total is reduced by $8,032,000: $7,171,000 of which was transferred to the SBIR program and $861,000 of which was transferred to the STTR program.

One measure of the progress in plasma physics to date can in part be seen in the fact that the densities and temperatures required for fusion on earth are now routinely obtained in the laboratory. Scaling the results from present fusion experiments to those required for energy production, this research is providing a stronger experimental basis for future fusion. But while experimental scaling of results is encouraging and important, progress in fusion science goes beyond this. It is grounded in an increasingly deep, experimentally validated theoretical understanding that is growing in parallel with these empirical accomplishments. This validation forms the foundation of computational tools used to understand and predict the behavior of natural and man-made plasmas systems, including burning plasmas for fusion energy. From this foundation, the ever-increasing sophistication of simulation with massively parallel computing is improving our ability to predict the performance of experimental systems. Such simulation is being used as a tool for discovery in itself and is guiding experimental choices, a sign of increasing maturity of the field and increasing readiness to embrace the practical challenges of fusion energy development.

The tools developed for advancing fusion's scientific base are also being used as tools for general scientific discovery beyond the fusion realm. An example is our increasing understanding of the anomalous heating of the solar corona, where plasma physics common to both fusion energy in the laboratory and plasmas in the natural world provides the basis for unraveling this mystery. Fusion's theory-based computational tools have also recently been used to explain the unexpectedly low brightness of the accretion of plasma in the extraordinary environment surrounding super massive black holes in the center of our galaxy. Once regarded as too complex to allow anything except an empirical approach, our understanding of the fundamental laws governing the gross dynamics of plasmas, including the challenge of understanding the nonlinearly saturated state of plasmas turbulence, has undergone significant transformation in the past 20 years.

The transformation of plasma science from empirical to predictive has come from a sustained investment in flexible experiments that can explore an ever-increasing range of plasma conditions, advanced diagnostics that sample plasma phenomena at temporal and spatial scales covering many orders of magnitude, and simulation capability that also can capture these disparate scales and offers the promise of integrated, validated simulation of burning plasmas in the laboratory and in future energy producing reactors. Importantly, plasma science has also been advanced by vigorous national and international collaboration where fusion's puzzles and challenges have been addressed in joint experiments promoted by international physics activities.

Today, FES investments are focused on extending this progress into the yet unexplored regime of self-sustaining, or burning, fusion reactions. Since the earliest work on fusion energy, most fusion reactor concepts have shared a common approach—the fusion fuel (usually a mixture of the hydrogen isotopes deuterium and tritium) is heated to extremely high temperatures (on the order of 100 million degrees) creating a plasma of ionized deuterium and tritium. Under these conditions, the deuterium and tritium nuclei fuse, releasing substantial amounts of energy.



The Fusion Process

Creating a burning plasma is the crucial next step in both the magnetic fusion energy science (MFES) and inertial fusion energy science (IFES) programs. A burning plasma is fundamentally different from the plasmas that have been created in research facilities to date, which have all been sustained entirely by external energy sources. In a burning plasma, the plasma temperature is sustained by the fusion reaction itself, primarily by the self-heating from alpha particles, energetic helium ions produced by the fusion reactions.

To sustain the fusion reactions and keep the fusion fuel at thermonuclear temperatures, the plasma must be contained and prevented from coming into contact with the comparatively cool walls of the confining vessel. In the decades that followed the first attempts at controlled thermonuclear fusion, two main approaches for confining fusion plasmas emerged: magnetic confinement and inertial confinement. FES supports research programs in magnetic fusion energy science and in plasma science, including activities related to IFES through investigation of the fundamental science of high energy density laboratory plasmas (HEDLP).

The MFES program is now moving into the burning plasma regime through the U.S. participation in ITER, an international fusion research facility under construction in Cadarache, France, which will be the world's first magnetic fusion facility large enough to achieve a burning plasma and investigate its characteristics. Under the ITER Joint Implementation Agreement (JIA), the United States is a full Member of the International ITER project—an unprecedented international scientific endeavor to explore the physics of burning plasmas. The 9.09% share of ITER construction gives the U.S. access to all scientific data, gives the U.S. the right to propose and carry out experiments, and creates new opportunities for U.S. industry to manufacture high-technology components to fulfill a large part (roughly 80%) of the U.S. contribution. In addition to ITER, the United States collaborates with these partners on current fusion research facilities and programs through International Energy Agency and bilateral agreements. The inertial fusion program within the National Nuclear Security Administration (NNSA) is also moving into the burning plasma regime with the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory.

With the initiation of the ITER project and the recent completion of NIF, plasma science research is at the threshold of new discoveries that will transform the field. Both magnetic fusion and inertial fusion sciences have progressed to the point where the fusion community has the knowledge not only to design a burning plasma device, but also to identify the broader scientific and technical questions that remain to be answered on the path to fusion energy. It is thus an opportune time for the FES program to tackle a wide range of scientific and technical challenges to the development of practical fusion energy.

The FES mission is advanced by four strategic goals:

- Advance the fundamental science of magnetically confined plasmas to develop the predictive capability needed for a sustainable fusion energy source;
- Pursue scientific opportunities and grand challenges in high energy density plasma science to explore the feasibility of the inertial confinement approach as a fusion energy source, to better understand our universe, and to enhance national security and economic competitiveness;
- Support the development of the scientific understanding required to design and deploy the materials needed to support a burning plasma environment; and
- Increase the fundamental understanding of basic plasma science, including both burning plasma and low temperature plasma science and engineering, to enhance economic competiveness and to create opportunities for a broader range of science-based applications.

These distinct but strongly linked and synergistic goals are unified by fundamental plasma science, the scientific foundation for a fusion energy source. The goals also reflect a synthesis of input from the National Academies, the Fusion Energy Sciences Advisory Committee (FESAC), and the U.S. fusion community.

The research activities supported by FES have led to a wide range of advances in fusion related sciences. Some representative advances include the achievement of an increase in fusion power output in laboratory experiments by 12 orders of magnitude over the past three decades, the development of advanced computation and simulation capability in the areas of energy transport and plasma stability needed to design a device capable of achieving a burning plasma with significant fusion energy output, and the demonstrated control of plasma states that scale favorably to burning plasmas and future fusion reactors.

Subprograms

To accomplish its mission and address the strategic goals described above, the FES program is organized into three subprograms—Science, Facility Operations, and Enabling R&D.

- The *Science* subprogram is developing a predictive understanding of plasmas properties, including their dynamics and their interactions with surrounding materials. The emphasis is presently weighted towards understanding the plasma state and its properties for stable magnetically confined fusion systems, but increasing emphasis is expected in the areas of plasma-material interaction and the simultaneous effects of high heat and neutron fluxes that will be encountered in a burning plasma environment. Also, plans call for extending this class of research activity, further leveraging the scientific basis established for magnetic fusion to other areas. This includes research to investigate the fundamental science of HEDLP.
- The *Facility Operations* subprogram includes efforts to build, operate, maintain, and upgrade the large facilities needed to carry out research on fusion energy science. It also includes funding for the U.S. share of the ITER project. The three major experimental facilities in the FES program—DIII-D tokamak at General Atomics in San Diego, California; the Alcator C-Mod tokamak at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts; and the National Spherical Torus Experiment (NSTX) at Princeton Plasma Physics Laboratory (PPPL) in Princeton, New Jersey—provide the essential tools for the U.S. research community to explore and solve fundamental issues of fusion plasma physics. All three are operated as national facilities and involve

users from many laboratories and universities. The funding for facility operations includes expenses for running the facility; providing the required plasma diagnostics; and for facility maintenance, refurbishment, and minor upgrades.

- The *Enabling R&D* subprogram supports research to optimize and control plasma states in the laboratory, increasing the scientific output of present experiments and the likelihood of success of future fusion facilities. Research is aimed at improving the components and systems that are used to build present and future fusion facilities, thereby enabling them to achieve improved performance and scientific output and bring us closer to the goal of achieving practical fusion energy.

Benefits

The development of plasma science has been motivated by a diverse set of applications such as astrophysics, space science, plasma processing, national defense, and fusion energy. Advances in plasma science have led to significant applications, such as plasma processing of semiconductors and computer chips, material hardening for industrial and biological uses, waste management techniques, lighting and plasma displays, space propulsion, and non-contact infection-free surgical scalpels. Particle accelerators and free electron lasers also rely on plasma science concepts.

Plasma science is essential to the development of fusion energy. Fusion has the potential to provide an energy source that is virtually inexhaustible and environmentally benign, producing no combustion products or greenhouse gases. While fusion is a nuclear process, the products of the fusion reaction (helium and neutrons) are not intrinsically radioactive. Short-lived radioactivity may result from interactions of the fusion products with the reactor walls, but with proper design a fusion power plant would be passively safe and would produce no long-lived radioactive waste. Design studies show that electricity from fusion could cost about the same as electricity from other sources.

The extreme states of matter studied in HEDLP and encountered in inertial confinement fusion studies may offer an alternate path to a fusion energy source. This research is also related to the NNSA stockpile stewardship program and, hence, indirectly supports the national security program of DOE. Related areas of science addressed in these research programs include turbulence and complex systems, multiphase interactions and plasma-material interactions, self-organization of complex systems, astrophysics, geodynamics, and fluids.

Program Planning and Management

FES uses a variety of external entities to gather input for making informed decisions on programmatic priorities and allocation of resources. As part of this effort, FES has developed a system of planning and priority setting that draws on advice from groups of outside experts. FES has also instituted a number of peer review and oversight measures designed to assess productivity and maintain effective communication and coordination among participants in FES activities.

During 2008 and 2009, FES sponsored a series of workshops focused on providing input for a new FES strategic plan. The first workshop covered the field of low temperature plasma physics and produced the report entitled *Low Temperature Plasma Science: Not only the Fourth State of Matter but All of Them*[a] in September 2008. More recently, FES organized a community-wide effort that culminated in an MFES Research Needs Workshop (ReNeW) in June 2009 to describe the scientific research required during the ITER era to develop the knowledge needed for a practical fusion power source. The report on the results from this workshop entitled *Research Needs for Magnetic Fusion Energy Sciences*[a] was published in September 2009. Two FESAC reports, *Priorities, Gaps and Opportunities: Towards a Long-Range*

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[a] The 2008/2009 reports are located at http://www.science.doe.gov/ofes/programdocuments.shtml.

Strategic Plan for Magnetic Fusion Energy (October 2007)[a] and *Report of the FESAC Toroidal Alternates Panel* (December 2008)[a], and a series of topical workshops provided the technical basis for this ReNeW workshop.

A Research Needs Workshop for HEDLP was held in November 2009 to evaluate research opportunities in fundamental high energy density plasma science and in inertial fusion energy related high energy density plasma science. A FESAC report on scientific issues and opportunities in both fundamental and mission-driven HEDLP, entitled *Advancing the Science of High Energy Density Laboratory Plasmas*, was used as the technical basis for the workshop. This report documents the issues and opportunities that can be pursued over the next decade through the joint program in HEDLP. SC and NNSA have jointly appointed FESAC as the federal Advisory Committee for the FES-NNSA joint program in HEDLP. The HEDLP ReNeW report is expected to be published in the March 2010 timeframe.

The reports from the research needs workshops will be used by FES as a major part of the input used in its strategic planning activities. The planning is aimed, in part, at accelerating work on the scientific and technical foundations for a fusion energy source. The planning activities will also describe increased FES stewardship of general plasma science as recommended by the National Research Council (NRC) report entitled *Plasma Science: Advancing Knowledge in the National Interest*[a].

To assist in the management and coordination of U.S. scientific and technical activities in support of ITER, and to prepare for the eventual participation by U.S. scientists in ITER operations and research, FES established the U.S. Burning Plasma Organization (USBPO). The USBPO Director is also the chief scientist for the U.S. ITER Project Office (USIPO), thus providing close coupling between the ITER Project and these scientific activities. The U.S. is also a very active member of the International Tokamak Physics Activity (ITPA) which facilitates international coordination of tokamak research in support of ITER.

FES requires the three major experimental facilities supported by the program to have Program Advisory Committees (PACs). The PACs serve an important role in providing guidance to the facility directors in the form of program review and advice regarding allocation of facility run-time. Composed primarily of researchers from outside the host facility, these PACs also include non-U.S. members.

FES charges FESAC to convene a Committee of Visitors (COV) panel every three years to assess the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document application, proposal, and award actions and the quality of the resulting portfolio. A new COV charge was given to FESAC in November 2008 asking FESAC to review the entire FES program and report its findings. The COV has conducted its review, meeting with the FES program staff in August 2009. The COV will present its findings to the full committee at the first FESAC meeting of 2010. The final FESAC report on this COV activity is expected to be published about one month after that FESAC meeting.

Basic and Applied R&D Coordination

As recommended in 2007 by the National Science and Technology Council in the *Report of the Interagency Task Force on High Energy Density Physics*[a], FES and NNSA have established a joint program in HEDLP to provide stewardship of high energy density laboratory plasma physics. The benefits of this joint program are that it will avoid duplication of effort, provide better leverage for the FES high energy density physics projects at the NNSA high energy density facilities, and stimulate synergies between the two programs and interactions among the researchers. High energy density plasmas are plasmas with pressures exceeding one million atmospheres (greater than 1 megabar). The science of high energy density plasmas is important to science-based nuclear stockpile stewardship as well as to inertial fusion energy. The FES high energy density physics program includes energy-related science and other fundamental research (e.g., laboratory astrophysics). At the present time this research includes the science of fast ignition, laser-plasma interaction, magnetized high energy density plasmas, high-density high Mach-number plasma jets, and heavy-ion-beam driven warm dense matter. This research overlaps with HEDLP areas funded by NNSA, including compressible and radiative hydrodynamics, laser-plasma interactions, material properties under extreme conditions, and laboratory astrophysics. FES and NNSA HEDLP research is being coordinated through the joint program, with coordinated solicitations, peer reviews, scientific workshops, and Federal Advisory Committee input.

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[a] The 2008/2009 reports are located at http://www.science.doe.gov/ofes/programdocuments.shtml.

Budget Overview

The FES program is the primary supporter of research in the field of plasma physics in the United States. The FY 2011 budget request is designed to optimize the scientific productivity of the program. The FES program funds activities involving over 1,100 researchers and students in 31 states at approximately 63 universities, 9 industrial firms, 10 national laboratories, and 2 Federal laboratories. Some of the key activities of the FES program and their status in the FY 2011 budget request follow:

- The United States will continue funding to meet our obligations in the Construction Phase of the ITER Project (U.S. Contributions to ITER Project) including research and development of key components, long-lead procurements, and contributions of personnel and funds to the ITER Organization (IO). In addition, the U.S., working in conjunction with the other partners, will continue to emphasize the importance of formal, coherent, and disciplined project management practices by the IO as a means to control schedule and cost.
- Research at the major experimental facilities in the FES program—DIII-D, Alcator C-Mod, and NSTX—will continue to focus on building the predictive science needed for ITER operations and providing solutions to high-priority ITER technical issues. More specifically, these facilities will conduct experiments to improve active control of various plasma parameters, measure the effects and mitigation of disruptions in the plasma, develop a better understanding of the physics of the plasma edge in the presence of large heat flows, control the current density profile for better stability, and develop a scientific basis of advanced operating scenarios for ITER. Maintaining a high level of facility usage and upgrades so as to best exploit these investments is a priority.
- The Fusion Simulation Program (FSP) transitions from its 2-year (FY 2009-FY 2010) planning phase to the full program. The FSP is a computational initiative led by FES with collaborative support from the Office of Advanced Scientific Computing Research (ASCR). It is aimed at the development of a world-leading, experimentally validated, predictive simulation capability for fusion plasmas in the regimes and geometries relevant for practical fusion energy.
- Plasma Science Centers (PSCs) support multi-institutional teams to work on some of the most important and challenging plasma science problems of our time. Recognizing this, FES will continue to provide support for the operation of three plasma science centers. The PSCs are intended to establish academic centers of excellence that will focus on fundamental issues of widely recognized importance to plasma science. In addition to the science that is fostered in this research, the education and training of plasma scientists is a major goal of this program.
- FES investments in emerging scientific opportunities in HEDLP are positioning the U.S. to assert strong leadership in this growing field of plasma science. FES and NNSA intend to expand the joint research program that was initiated in FY 2009. The Materials in Extreme Conditions (MEC) end station at the recently commissioned Linac Coherent Light Source at SLAC will permit studies of high energy states of matter with unprecedented precision. The Neutralized Drift Compression

Experiment-II (NDCX-II) will enable enhanced warm dense matter experiments relevant to the interiors of giant planets and to the high energy density science underpinning the concept of heavy ion fusion. This program will continue to explore a number of fields of research identified as priorities by both the National Academies and FESAC, including basic research on the science of fast ignition, laser-plasma interaction, magnetized high energy density plasmas, plasma jets, and warm dense matter. An increase is proposed in FY 2011 with further increases planned for future years.

- A modest increase in fusion-related materials science research is proposed in this budget. One of the clearest recommendations that comes from the magnetic fusion community from the ReNeW process and underscored by the FESAC report entitled "*Priorities, Gaps, and Opportunities*," described above, is the need to develop the materials science essential to practical fusion energy. Indeed, pursuit of this research by the United States provides an opportunity to assert leadership worldwide in this important area. Full maturation of this endeavor in the coming years will require sensible collaboration with other research programs in the Department, including those stewarded by Basic Energy Sciences.

Annual Performance Results and Targets

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering.

GPRA Unit Program Goal: Fusion Energy Sciences Program Goal: Bring the Power of the Stars to Earth - Answer the key scientific questions and overcome enormous technical challenges to harness the power that fuels our Sun.

Annual Performance Measure: Conduct experiments on the major fusion facilities (DIII-D, Alcator C-Mod, NSTX) leading toward the predictive capability for burning plasmas and configuration optimization.

FY 2006	T: Inject 2 MW of neutral beam power in the counter direction on DIII-D and begin physics experiments. A: Goal met
FY 2007	T: Measure and identify magnetic modes on NSTX that are driven by energetic ions traveling faster than the speed of magnetic perturbations (Alfvén speed); such modes are expected in burning plasmas such as ITER. A: Goal met
FY 2008	T: Evaluate the generation of plasma rotation and momentum transport, and assess the impact of plasma rotation on stability and confinement. Alcator-Mod will investigate rotation without external momentum input, NSTX will examine very high rotation speeds, and DIII-D will vary rotation speeds with neutral beams. The results achieved at the major facilities will provide important new data for estimating the magnitude of and assessing the impact of rotation on ITER plasmas. A: Goal met

FY 2009	T: Identify the fundamental processes governing particle balance by systematically investigating a combination of divertor geometries, particle exhaust capabilities, and wall materials. Alcator C-Mod operates with high-Z metal walls, NSTX is pursuing the use of lithium surfaces in the divertor, and DIII-D continues operating with all graphite walls. Edge diagnostics measuring the heat and particle flux to walls and divertor surfaces, coupled with plasma profile data and material surface analysis, will provide input for validating simulation codes. The results achieved will be used to improve extrapolations to planned ITER operation. A: Goal met
FY 2010	T: Conduct experiments on major fusion facilities to improve understanding of the heat transport in the tokamak scrape-off layer (SOL) plasma, strengthening the basis for projecting divertor conditions in ITER. The divertor heat flux profiles and plasma characteristics in the tokamak SOL will be measured in multiple devices to investigate the underlying thermal transport processes. The unique characteristics of C-Mod, DIII-D, and NSTX will enable collection of data over a broad range of SOL and divertor parameters (e.g., collisionality, beta, parallel heat flux, and divertor geometry). Coordinated experiments using common analysis methods will generate data that will be compared with theory and simulation. A: TBD
FY 2011	T: Improve the understanding of the physics mechanisms responsible for the structure of the pedestal and compare with the predictive models described in the companion theory milestone. Perform experiments to test theoretical physics models in the pedestal region on multiple devices over a broad range of plasma parameters (e.g., collisionality, beta, and aspect ratio). Detailed measurements of the height and width of the pedestal will be performed augmented by measurements of the radial electric field. The evolution of these parameters during the discharge will be studied. Initial measurements of the turbulence in the pedestal region will also be performed to improve understanding of the relationship between edge turbulent transport and pedestal structure. A: TBD
FY 2012–2015	T: TBD based on research needs and FY 2011 through 2014 results A: TBD

Annual Performance Measure: Continue to increase resolution in simulations of plasma phenomena—optimizing confinement and predicting the behavior of burning plasmas require improved simulations of edge and core plasma phenomena, as the characteristics of the edge can strongly affect core confinement.

FY 2006	T: Simulate nonlinear plasma edge phenomena using extended MHD codes with a resolution of 40 Toroidal modes. A: Goal met

FY 2007	T: Improve the simulation resolution of linear stability properties of Toroidal Alfvén Eigenmodes driven by energetic particles and neutral beams in ITER by increasing the number of Toroidal modes used to 15. A: Goal met
FY 2008	T: Improve the simulation resolution of ITER-relevant modeling of lower hybrid current drive experiments on Alcator C-Mod by increasing the number of poloidal modes used to 2,000 and the number of radial elements used to 1,000 using the SC's high performance computing resources. A: Goal met
FY 2009	T: Gyrokinetic edge electrostatic turbulence simulations will be carried out across the divertor separatrix with enhanced resolution down to the ion gyroradius scale. A: Goal met
FY 2010	T: Gyrokinetic simulations of turbulent transport of toroidal momentum with both kinetic and Boltzmann electrons will be carried out. These simulations will explore the Ion Temperature Gradient (ITG) and the Collisionless Trapped Electron Mode (CTEM) regimes. A: TBD
FY 2011	T: A focused analytic theory and computational effort, including large-scale simulations, will be used to identify and quantify relevant physics mechanisms controlling the structure of the pedestal. The performance of future burning plasmas is strongly correlated with the pressure at the top of the edge transport barrier (or pedestal height). Predicting the pedestal height has proved challenging due to a wide and overlapping range of relevant spatiotemporal scales, geometrical complexity, and a variety of potentially important physics mechanisms. Predictive models will be developed and key features of each model will be tested against observations, to clarify the relative importance of various physics mechanisms, and to make progress in developing a validated physics model for the pedestal height. A: TBD
FY 2012–2015	T: TBD based on research needs and FY 2011 through 2014 results A: TBD

Annual Performance Measure: Average achieved operation time of the major national fusion facilities (DIII-D, Alcator C-Mod, NSTX) as a percentage of the total planned operation time is greater than 90%.

FY 2006	T: 90% of scheduled operating time A: Goal met

FY 2007	T: 90% of scheduled operating time A: Goal met
FY 2008	T: 90% of scheduled operating time A: Goal met
FY 2009	T: 90% of scheduled operating time A: Goal met
FY 2010–2015	T: 90% of scheduled operating time A: TBD

Annual Performance Measure: Cost-weighted mean percent variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects kept to less than 10%.

FY 2006	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2007	T: Cost and schedule variance are both less than 10% A: Goal not met
FY 2008	T: Cost and schedule variance are both less than 10% A: Goal not met
FY 2009	T: N/A, no major construction project/MIE tracked this fiscal year.
FY 2010	T: N/A, no major construction project/MIE tracked this fiscal year.
FY 2011–2015	T: Cost and schedule variance are both less than 10% A: TBD

Science

Funding Schedule by Activity

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Science			
Tokamak Experimental Research	50,121	58,177	53,781
Alternative Concept Experimental Research	65,684	65,780	72,269
Theory	24,014	24,348	24,348
Advanced Fusion Simulations	9,163	11,212	13,212
General Plasma Science	14,497	14,193	14,193
SBIR/STTR	0	8,382	8,137
Total, Science	163,479	182,092	185,940

Description

The Science subprogram supports preparation for the eventual exploration of burning plasmas by developing a scientific understanding of how high temperature plasmas behave in a tokamak magnetic confinement configuration. The Science subprogram is focused on advancing understanding of plasmas and the fusion environment through an integrated program of experiments, theory, and simulation as outlined in FESAC's *Scientific Challenges, Opportunities and Priorities for the Fusion Energy Sciences Program, July 2004*[a] report.

Plasmas are gases comprising of a mixture of ions and electrons that are influenced by the long range interactions with each other and by magnetic and electric fields, either externally applied or generated by the plasma itself. The Science subprogram focuses on two key questions: What are the physical processes that govern the behavior of a plasma, especially a high temperature plasma, and how do you create, confine, heat, and control a burning plasma to make fusion power a reality? These questions are inherently linked, since a profound understanding of plasma science will be needed to learn how to bring the power of the stars to Earth. This linkage is captured in a major goal of the Science subprogram: to develop a predictive understanding of high temperature fusion burning plasmas in a range of confinement configurations.

The Science subprogram is actively pursuing the development of a broad range of advanced computational simulation tools, taking advantage of emerging petascale computing resources, to address and predict in an integrated manner the questions of how a burning plasma will behave. This effort will yield the computational tools needed to help fully utilize ITER and should also keep the U.S. science community in the lead in using high performance computers to advance understanding of the plasma state. Ultimately, research on ITER is expected to provide sufficient information on burning plasmas to make a definitive assessment of the scientific feasibility of fusion power.

Selected FY 2009 Accomplishments

- *Low absorption of fusion fuel by material walls in high-confinement plasma experiments*: A major concern for ITER is the need to minimize the amount of the tritium fuel absorbed into the vessel walls, as high absorption rates could shorten the lifetimes of components. A set of coordinated experiments in the DIII-D and Alcator C-Mod tokamaks demonstrated that particle absorption into the wall in the operational regime favored for ITER is very small, perhaps zero. Virtually the entire uptake of the wall materials may only occur during the short, early phase of the discharge prior to the transition to the operating regime. This finding has significant implications for ITER operations.

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[a] The 2008/2009 reports are located at http://www.science.doe.gov/ofes/programdocuments.shtml.

- *Advances in predicting plasma behavior:* The NSTX team has detected theoretically-predicted small scale density fluctuations by observing scattered microwaves launched into the plasma. This turbulence is challenging to measure because of its small scale size and amplitude, yet is of potentially high importance to determining how energy created by the fusion process diffuses to the reactor walls. Researchers at the Madison Symmetric Torus (MST) reversed-field pinch have made the first ever measurement of electromagnetic turbulence in the core of a high-temperature plasma. Using newly developed laser-based techniques they were able to simultaneously measure electron density fluctuations and magnetic field fluctuations, providing a direct glimpse into the nature of the transport of electrons in a stochastic magnetic field. This is of critical interest to magnetic fusion energy research as stochastic fields may be applied in a reactor to control undesirable pulses of heat from the plasma boundary to the reactor walls. On the DIII-D tokamak, scientists used localized microwave heating to vary the turbulence in a reproducible manner by controlling local temperature gradients. Comparison between measurement and state-of-the-art plasma simulations shows general agreement with the computed turbulence, but not with the resulting energy transport, thus motivating further improvements to the theory.
- *Improved understanding of plasma viscosity in 3D magnetic fields:* Recent advances in the theory of the coupling between plasmas and 3D magnetic field perturbations have provided new insight for controlling plasma rotational shear in tokamaks. Strong rotation improves plasma stability and strong rotational shear reduces turbulent transport, leading to high energy confinement. Recent experiments in DIII-D that measured the applied torque and resulting plasma rotation have observed a dependence on plasma collisionality as predicted by theory. Related experiments used static 3D fields to produce the high edge rotational shear needed to produce high confinement. These results have important positive implications for achieving and maintaining the required edge rotation in ITER.
- *Exploration of possible improved confinement mode for ITER*: Achieving good energy confinement without deleterious effects such as edge-localized modes (ELMs) or impurity accumulation is a critical issue for ITER. An improved energy confinement mode was discovered and is being explored on the Alcator C-Mod tokamak. The characteristics of the new mode include: normalized energy confinement at the level required by ITER, while keeping the plasma clean of impurity particles, and enabling high temperatures due to the good energy confinement. Separating energy and particle confinement, this improved confinement mode also avoids edge-localized plasma instabilities (ELMs). The possible extrapolation of this regime to ITER is currently under active investigation.
- *Fast ignition:* The first instrumented integrated fast ignition experiment in the United States has just been performed in the OMEGA Laser Facility at the University of Rochester. Preliminary assessment of the experimental data indicated that when a second (short) laser pulse was applied during inertial confinement of the target, the neutron yield was increased by two to three fold.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Tokamak Experimental Research	**50,121**	**58,177**	**53,781**

The tokamak magnetic confinement concept has been the most effective approach to date for confining high-temperature plasmas in a laboratory environment. Many of the important issues in fusion science are being studied in tokamaks, including the two major U.S. tokamak facilities: DIII-D and Alcator C-Mod. In association with the International Tokamak Physics Activity (ITPA), U.S. tokamaks continue to give high priority to joint experiments with tokamak facilities in Europe and Japan to resolve ITER-relevant physics issues.

Today, tokamak experimental research is marked by plasma measurements of unprecedented detail and accuracy, excellent plasma control, and strong connections to theory and simulation efforts. Both DIII-D and Alcator C-Mod use flexible plasma shaping and dynamic control capabilities to attain good confinement and stability. They control the distribution of current in the plasma with electromagnetic wave heating and current drive. The interface between the plasma edge and the material walls of the confinement vessel is managed by means of a magnetic divertor and magnet coils for fine control. Through tokamak research, the science of plasma confinement, plasma control, plasma responses to heating and fueling sources, and plasma-wall interactions has matured sufficiently to establish the physics basis for ITER and continues to advance rapidly.

Both DIII-D and Alcator C-Mod are operated as national collaborative science facilities with research programs established through public research forums, program advisory committee recommendations, and peer review. Both programs are also closely coordinated with international tokamak research through collaborations with major foreign tokamaks in the European Union, Japan, China, and Korea. As JET and ASDEX-UG in Europe undergo hardware modifications in 2010 and as the new superconducting tokamak programs in China (Experimental Advanced Superconducting Tokamak, EAST) and Korea (Korean Superconducting Tokamak Advanced Research, KSTAR) advance their research operations, increases in international collaborations are planned. These will address ITER physics, steady-state physics, and technology issues that are not currently being addressed in U.S. facilities.

In FY 2011, U.S. tokamak researchers will continue to expand the frontiers of fusion science, both to address remaining ITER questions and to develop the basis for practical fusion power plants.

	FY 2009	FY 2010	FY 2011
▪ **DIII-D Research**	**25,740**	**27,504**	**26,604**

The DIII-D tokamak at General Atomics in San Diego, California, is the largest magnetic fusion facility in the United States. DIII-D provides for considerable experimental flexibility and has extensive diagnostic instrumentation to measure the properties of high temperature plasmas. It also has unique capabilities to shape the plasma and provide feedback control of error fields that, in turn, affect particle transport and plasma stability. DIII-D has been a major contributor to the world fusion program over the past two decades.

The DIII-D program is operated as a national research effort, with extensive participation from many U.S. laboratories and universities who receive direct funding from FES. The DIII-D program also plays a central role in U.S. international collaborations with the European Union, Japan, Korea, China, India, and the Russian Federation, hosting many foreign scientists, as well as sending DIII-D scientists overseas to participate in foreign experiments. The primary goal of the DIII-D program is to establish the scientific basis for the optimization of the tokamak approach to fusion energy. This is

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

being accomplished by advancing basic scientific understanding across a broad front of fusion plasma topical areas including transport, stability, plasma-wave physics, and boundary layer physics using a magnetic divertor to control the magnetic field configuration at the edge of the plasma. These topics are integral parts of six physics groups in the DIII-D Experimental Science Division: Steady State Integration, Integrated Modeling, ITER Physics, Plasma Control and Operations, Fusion Science, and Plasma Boundary Interfaces. In addition, three cross-cutting task groups focus on rapid shutdown schemes for ITER, the physics of non-axisymmetric field effects for ITER, and transport model validation. Over the past few years, the investigation of ITER-relevant discharge scenarios, including the development of advanced enhanced performance scenarios, has gained emphasis in the DIII-D experimental program.

The FY 2011 experimental program on DIII-D will commence in April 2011, after a year-long shutdown from April 2010 to March 2011 for facility modifications. These modifications primarily include re-orientation of one of the neutral beam lines for off-axis current drive capability and installation of plasma control coils on the tokamak center post. The FY 2011 experimental program will exploit these new facility modifications and continue to focus on experiments to provide solutions to key ITER issues and build a firm physics basis for ITER program planning. The DIII-D program will also continue to accommodate a number of joint experiments in collaboration with the international community.

	FY 2009	FY 2010	FY 2011
▪ **Alcator C-Mod Research**	**9,002**	**9,045**	**9,045**

Alcator C-Mod is a unique, compact tokamak facility that uses intense magnetic fields to confine high-temperature, high-density plasmas in a small volume. It is the only tokamak in the world operating at and above the ITER design magnetic field and plasma densities, and it produces the highest pressure tokamak plasma in the world, approaching pressures expected in ITER. It is also unique in the use of all-metal walls to accommodate high power densities. By virtue of these characteristics, Alcator C-Mod is particularly well suited to operate in plasma regimes that are relevant to ITER. The facility has made significant contributions to the world's fusion program in the areas of plasma heating, stability, confinement, non-inductive current drive, and rotational flows in high field tokamaks, all of which are important integrating issues for burning plasmas.

In FY 2011, Alcator C-Mod will continue a strong research program, while providing support of ITER. Experiments will address issues with the generation of sheaths by radio frequency (RF) heating of the plasma discharge. A new type of ion cyclotron range of frequency antenna that better matches the geometry of the C-Mod magnetic field lines will be the primary tool in these experiments. Impurity generation via the formation of sheaths is an undesirable byproduct of RF heating in present day plasmas. Current drive experiments using a new type of microwave launcher at the lower hybrid range of frequencies will also be possible at high powers as more klystrons are currently being purchased using Recovery Act funding.

Other ITER-relevant topics that the Alcator C-Mod team will continue to focus on in FY 2011 include characterization of the H-mode pedestal at the edge of the plasma, plasma surface interaction with all-metal walls (especially in the divertor area), measuring the effects of and mitigating disruptions in the plasma, understanding the physics of the plasma edge in the presence of large heat flows, controlling the current density profile for better stability, and helping to build international cross-machine databases using dimensionless parameter techniques. The main effort will shift to developing accurate models of the plasma edge, an activity important to both ITER and to a potential future demonstration project. C-Mod will also continue participation in many joint international experiments.

	FY 2009	FY 2010	FY 2011
▪ **International Research**	**5,487**	**4,935**	**4,935**

In addition to their work on domestic experiments, scientists from the FES program participate in leading-edge scientific experiments on fusion facilities abroad in Europe, Japan, China, South Korea, the Russian Federation, and India—the ITER members—and conduct comparative studies to enhance the understanding of underlying physics of fusion plasmas. The FES program, in return, hosts visiting scientists from the international community for participation in U.S. experiments. The FES program has a long-standing policy of seeking international collaboration. This allows U.S. scientists to have access to the unique capabilities of fusion facilities around the world. These include the world's highest performance tokamak, the Joint European Torus (JET) in England; a stellarator, the Large Helical Device in Japan; a superconducting tokamak, Tore Supra in France; the AxiSymmetric Divertor Experiment Upgrade (ASDEX-U) and Tokamak Experiment for Technology Oriented Research (TEXTOR) in Germany; and several smaller devices. In addition, the U.S. is collaborating with China and South Korea on EAST and KSTAR respectively, which have become operational in the past two years. The U.S. collaborations on these two new superconducting tokamaks were instrumental in achieving their first plasmas in September 2006 and June 2008, respectively. These collaborations provide a valuable link with the 80% of the world's fusion research that is conducted outside the U.S. and provide a firm foundation to support ITER activities.

In FY 2011, the U.S. will continue to be a major participant in the ITPA, which identifies experimental and computational studies to resolve high priority ITER physics design needs and implements these studies through collaborative work among the world's leading experimental and theoretical research teams. These studies include joint ITPA experiments and other joint ITER-relevant experiments in the areas of plasma wall interactions, plasma instabilities, and first wall design considerations for ITER. The JET tokamak in the United Kingdom and the ASDEX-U tokamak in Germany will be restarting after year-long shutdowns in 2010 for facility modifications involving an ITER-like wall and internal control coils. The KSTAR and EAST tokamaks in Korea and China respectively will be maturing in their operational capability. All of these modifications and improvements in the international tokamaks will provide an opportunity to expand collaborations and joint experiments utilizing these new tools. To develop these collaboration options, a national committee has been assembled to identify further U.S. international research opportunities that can be developed in the coming years.

	FY 2009	FY 2010	FY 2011
▪ **Diagnostics**	**4,082**	**3,912**	**3,920**

Support for the development of unique measurement capabilities (diagnostic instruments) will continue. Diagnostic instruments serve two important functions: to provide a link between theory/computation and experiments, thereby increasing the understanding of the complex behavior of the plasma in fusion research devices; and to provide sensory tools for feedback control of plasma properties in order to enhance device operation.

In FY 2011, research will include the development of diagnostics for fundamental plasma parameter measurements, state-of-the-art measurement techniques, and R&D for ITER-relevant diagnostic systems. Diagnostic systems will be installed and operated on current experiments in the U.S. and on non-U.S. fusion devices, where appropriate, through collaborative programs.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

A competitive peer review of the national laboratory component of the diagnostics development program will be conducted in FY 2011.

▪ **Other**	**5,810**	**12,781**	**9,277**

Funding in this category supports educational activities such as research at historically black colleges and universities, postgraduate fellowships in fusion science and technology, and summer internships for undergraduates. In addition, funding in this category supports outreach efforts related to fusion science and enabling R&D, and the activities of the U.S. Burning Plasma Organization and the Fusion Energy Sciences Advisory Committee. Beginning in FY 2011 new fellowships will be funded through the Office of Science Graduate Fellowship (SCGF) program, which is funded by the Workforce Development for Teachers and Scientists program. This program was initiated in FY 2010 and supports graduate students pursing advanced degrees in areas of basic research supported by the Office of Science, including fusion science.

Alternative Concept Experimental Research	**65,684**	**65,780**	**72,269**

This program element broadens the fusion program by exploring the science of confinement optimization in the extended fusion parameter space, with plasma densities spanning twelve orders of magnitude, by seeking physics pathways to improve confinement, stability, and reactor configurations. Through this scientific diversity, the program element adds strength and robustness to the overall fusion program by lowering overall programmatic risks in the quest for practical fusion power in the long term, for which economic and environmental factors are important. At present, two alternate concepts are being pursued at the larger-scale, proof-of-principle level. A number of concepts are also being pursued at a concept-exploration level, as well as research in establishing a knowledge base for high energy density plasmas. The smaller scale experiments and the cutting-edge research have proven to be effective in attracting students and strongly contribute to fusion workforce development and the intellectual base of the fusion program. The research has also resulted in new ideas for the larger toroidal devices, including ITER.

▪ **NSTX Research**	**17,104**	**17,549**	**17,549**

The National Spherical Torus Experiment (NSTX) is one of only two large research facilities in the world that are exploring the spherical torus (ST) confinement configuration; the other is the MegaAmp Spherical Tokamak (MAST) in the United Kingdom. The ST is an innovative confinement configuration that produces a plasma that is shaped like a sphere with a narrow cylindrical hole through its center. The properties of an ST plasma are significantly different from a conventional tokamak plasma, which is shaped like a donut with a large hole through the center. Results to date indicate that STs can achieve a higher plasma pressure for a given applied magnetic field than conventional tokamaks and could, therefore, lead to a cost-effective facility for carrying out the nuclear engineering science research needed to design the power extraction and tritium breeding systems for a fusion power plant.

NSTX is operated as a national collaborative research facility, with extensive involvement of researchers from other national laboratories, universities, and industry who receive their funding from FES via a competitive peer review process.

In FY 2011 the NSTX program will continue to explore and understand the unique physics properties of STs, exploit these unique properties to contribute to the physics basis for ITER, and advance the fundamental understanding of ST plasmas to establish attractive scenarios for future fusion facilities. Using a liquid lithium divertor to confront the harsh plasma environment and new diagnostic capabilities, NSTX researchers will perform critical experiments to understand non-inductive current drive at reduced collisionality. In addition, they will investigate means to handle the large heat and particle fluxes that will fall on the divertor surface. They will also seek to understand the relation between electron energy confinement and fluctuations in the plasma density and electron temperature. This knowledge is needed to extrapolate to next-step facilities, and NSTX has unique capabilities to investigate this topic. NSTX researchers will continue studying macroscopic instabilities and will focus on sustaining high pressure plasmas and understanding disruption limits. The basic principles of error field correction and resistive wall mode control have been demonstrated, so future work will focus on developing reliable active control techniques to stabilize these modes. Plasma-wave interaction studies will concentrate on developing a predictive understanding of the redistribution/loss of fast-ions due to energetic particle modes. Research on energetic particle modes will also lead to increased knowledge of how the plasma current density is modified by energetic ion driven instabilities and how this will affect the ability to sustain the plasma with currents driven by injected high energy particle beams. Finally, experiments on solenoid-free start-up and current ramp-up, capabilities needed for future ST devices, will focus on reducing impurity influx during co-axial helicity injection start-up and using radio frequency waves to ramp-up the plasma current.

	FY 2009	FY 2010	FY 2011
▪ **Experimental Plasma Research**	**16,975**	**16,765**	**16,765**

The Experimental Plasma Research activity focuses on the exploration of Innovative Confinement Concepts (ICC)—small-scale facilities that explore emerging concepts for plasma confinement and stability. Recent investments have supported construction and operation of a range of facilities, an ICC-centric theory center, and several small topic-specific investigations. The facilities built include stellarators, spheromaks, field-reversed configurations, a levitated dipole, a flow-stabilized z-pinch, centrifugally confined magnetic mirrors, and electrostatic confinement. These studies have intrinsic value to FES's plasma science and fusion energy missions since they provide unique tests and extensions to enhance the understanding of confined plasmas, complementing the larger tokamak programs and helping to establish the predictive understanding of fusion plasma behavior. The program is undergoing a peer review in FY 2010, the goal of which is to select a portfolio of concepts to generate sufficient experimental data to elucidate the underlying physics principles upon which these concepts are based and, as needed, to develop computational models of promising concepts to a sufficient degree of scientific fidelity to allow an assessment of the relevance of those concepts to future fusion energy systems. New emphasis will be placed on the ability of some elements in this portfolio to contribute to the science needed in order to deepen our understanding of burning plasmas such as ITER.

In FY 2011, experimental plasma research will continue to examine novel three-dimensional confinement systems that address potential deficiencies in the tokamak and support development of instability mitigation techniques for ITER. Stellarators remain a top alternative confinement concept that can mitigate several of the potential deficiencies of the tokamak configuration. Research on the stellarator concept is continuing in FY 2011 within this program, such as developing knowledge of quasi-symmetric stellarator confinement as the basis for a credible, innovative approach to fusion energy.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
- **High Energy Density Laboratory Plasmas**	**24,753**	**24,551**	**31,040**

High energy density laboratory plasma physics is the study of ionized matter at extremely high density and temperature. According to the 2007 National Academies report on *Plasma Science: Advancing Knowledge in the National Interest*, high energy density (HED) physics begins when matter is heated or compressed (or both) to a point that the stored energy in the matter reaches approximately 10 billion Joules per cubic meter. This corresponds to a pressure of approximately 100,000 atmospheres. HED conditions exist in the interior of the Sun where hydrogen has been fused to produce energy. Supernovae, gamma ray bursts, accretion disks around black holes, pulsars, and astrophysical jets are examples of HED astrophysical phenomena. On Earth, HED conditions can only be created transiently in the laboratory by using intense pulses of lasers, particle beams (electrons or ions), plasma jets, magnetic pinches, or their combinations. Because of its potentially immense impact on energy security, the National Academies report recommended that SC provide stewardship of HED plasma science related to inertial fusion including the use of magnetized targets.

In FY 2011, the proposed budget will allow a significant expansion of the FES HEDLP initiative launched in FY 2009. On-going research includes studies of warm dense matter driven by heavy ion beams, fast ignition, magnetized high energy density plasmas, and high mach number and high density plasma jets. Funding awards will be determined by competitive peer-review and recommendations from workshops and conferences.

To enhance the study of the field of high energy density matter, FES is building a Matter in Extreme Conditions (MEC) Instrument project at the SLAC National Accelerator Laboratory Linac Coherent Light Source (LCLS) with Recovery Act funding. LCLS is the world's first coherent hard x-ray laser and the MEC project will enable high energy density matter to be probed and controlled by this advanced coherent x-ray source with unprecedented spatial and temporal resolution. Recovery Act funding will be used to expedite completion of the MEC instrument. Recovery Act funding is also enabling the construction of the Neutralized Drift Compression Experiment-II (NDCX-II), which will facilitate studies of warm dense matter and the high energy density physics intrinsic to the science of heavy ion fusion.

- **Madison Symmetrical Torus**	**6,852**	**6,915**	**6,915**

The goals of the Madison Symmetrical Torus (MST) at the University of Wisconsin-Madison are to obtain a fundamental understanding of the physics of reversed field pinches (RFPs), particularly magnetic fluctuations and their macroscopic consequences, and to use this understanding to develop the RFP fusion configuration. The RFP is geometrically similar to a tokamak, but with a much weaker externally applied magnetic field that reverses direction near the edge of the plasma. Research in the RFP's self-organization properties has astrophysical applications and may lead to a more cost-effective fusion system. The plasma dynamics that limit the energy confinement and plasma pressure, as well as novel means to the sustainment of the plasma current, are being investigated in this experiment. MST is one of the four leading RFP experiments in the world and is unique in that it pioneered the reduction of magnetic fluctuations by current density profile control. Since 2005 this approach has led to a ten-fold increase in energy confinement time.

In FY 2011, the major plans for the MST program are to assess the confinement of energetic ions using approximately 1 megawatt neutral beam injection, advance inductive current profile control and sustainment methods using a programmable power supply for the toroidal field, and assess the

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

anisotropy of ion heating from magnetic reconnection using parallel and perpendicular charge exchange recombination spectroscopy.

Theory	**24,014**	**24,348**	**24,348**

The Theory program provides the conceptual scientific underpinning of the magnetic fusion energy sciences program by supporting three thrust areas: burning plasmas, fundamental understanding, and configuration improvement. Theory efforts describe the complex multiphysics, multiscale, non-linear plasma systems at the most fundamental level and, in doing so, generate world-class science. These descriptions—ranging from analytic theory to highly sophisticated computer simulation codes—are used to interpret results from current experiments, plan new experiments on existing facilities, design future experimental facilities, and assess projections of facility performance. The program focuses on both tokamaks and alternate concepts. Work on tokamaks is aimed at developing a predictive understanding of advanced tokamak operating modes and burning plasmas—both of which are important to ITER—while the emphasis on alternate concepts is on understanding the fundamental processes determining equilibrium, stability, and confinement for each concept. The theory program also provides the input needed in the FES large-scale simulation efforts that are part of the SciDAC portfolio and, together with SciDAC, is expected to lead to a predictive understanding of how fusion plasmas can be sustained and controlled.

The Theory program is a broad-based program with researchers located at six national and federal laboratories, over thirty universities, and several private companies. Theorists in larger groups, located mainly at national laboratories and in private industry, generally support major experiments, work on large problems requiring a team effort, or tackle complex issues requiring multidisciplinary teams. Those at universities tend to support smaller, innovative experiments or work on more fundamental problems in plasma physics while training the next generation of fusion plasma scientists.

In FY 2011 the Theory Program will focus particular attention on many important scientific issues, including:

- turbulent transport of toroidal and poloidal momentum in tokamak plasmas and the understanding of spontaneous toroidal rotation,
- progress toward a predictive understanding of particle and electron transport,
- the physics of the edge pedestal and the transition from low to the high confinement modes in tokamaks,
- the formation of edge and internal transport barriers,
- a first-principles formulation of moment closures in extended magnetohydrodynamics models,
- calculations atomic and molecular collision processes of importance in fusion reactors,
- studies of how to improve the stellarator concept and find configurations that are less prone to the formation of islands, the study of other innovative confinement concepts,
- understanding fast magnetic reconnection in high temperature fusion plasmas, and
- development of predictive integrated computational models for tokamak plasmas.

Developing a validated predictive capability is very important, and in FY 2011, the theory program is exploring the possibility of having, as its annual performance target, a joint theory/computational/experiment milestone aimed at understanding the physics mechanisms responsible for the structure of the pedestal and developing a predictive capability. If this happens, it will be the first time that the theory program has been joined with the experimental and computational programs in an

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

integrated joint research effort in support of an annual performance target.

Advanced Fusion Simulations	**9,163**	**11,212**	**13,212**

The FES Advanced Fusion Simulations program includes projects funded under the auspices of the SC Scientific Discovery through Advanced Computing (SciDAC) program as well as a new computational activity focused on integrated modeling, the Fusion Simulation Program (FSP).

▪ **SciDAC**	**7,163**	**7,212**	**7,212**

The SciDAC program is a set of coordinated research efforts across all SC programs overseen by the Advanced Scientific Computing Research (ASCR) program with the goal of achieving breakthrough scientific advances through computer simulation that would have been impossible using theoretical or laboratory studies alone. By taking advantage of significant recent advances in computing technologies, the SciDAC program encourages and enables a new model of multi-disciplinary collaboration among physical scientists, mathematicians, computer scientists, and computational scientists. The product of this collaborative approach is a new generation of scientific simulation codes with high physics fidelity that can fully exploit the emerging capabilities of petascale computing resources.

The current FES SciDAC portfolio includes eight projects focused on the plasma science of magnetic fusion. Of these projects, five are focused on single-issue topical science areas, such as macroscopic stability, the simulation of electromagnetic wave-plasma interaction, the study of turbulent transport in burning plasmas, and the physics of energetic particles. The remaining three projects are known as *Fusion Simulation Prototype Centers* or proto-FSPs and focus on code integration and computational framework development in the areas of edge plasma transport, interaction of RF waves with magnetohydrodynamic instabilities, and the coupling of the edge and core regions of tokamak plasmas.

In FY 2011, following a peer review scheduled for mid-2010, the projects of the resulting FES SciDAC portfolio will continue to focus their efforts on grand challenge scientific questions of importance to burning plasmas and ITER and will also address high-priority issues identified during the recently held Research Needs Workshop (ReNeW) for the Magnetic Fusion Sciences part of the FES program.

In FY 2011, the proto-FSP Centers will continue to focus their efforts on issues of importance to burning plasmas and ITER such as using RF waves to control and mitigate performance-limiting macroscopic instabilities in fusion devices, the development of a first-principles predictive edge pedestal and edge localized modes model for ITER, and the development of advanced computational frameworks for integrated fusion simulations that enable the seamless coupling of the edge and core regions of tokamak plasmas. In addition, as the FES program starts the full Fusion Simulation Program in FY 2011 following a 2-year planning study, the proto-FSPs will work with the FSP team to coordinate their eventual integration within the larger program.

▪ **Fusion Simulation Program**	**2,000**	**4,000**	**6,000**

The Fusion Simulation Program (FSP) is a computational initiative led by FES with collaborative support from ASCR. It is aimed at the development of a world-leading, experimentally validated, predictive simulation capability for fusion plasmas in the regimes and geometries relevant for practical fusion energy. The FSP will take advantage of the emergence of SC petascale computing

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

capabilities and the scientific knowledge enabled by the FES and ASCR research programs, in particular those under the auspices of the SciDAC program. The FSP will contribute significantly toward the FES mission of developing the scientific basis for fusion energy, as well as its long term goal of developing a predictive capability for burning plasmas. It will also help the U.S. sustain and strengthen its leadership in advanced fusion computations.

In FY 2009, following peer review, FES selected a multi-institutional interdisciplinary team of six national laboratories, nine universities, and two private companies to carry out a two-year detailed planning study for the FSP. The FSP planning team, led by the Princeton Plasma Physics Laboratory, includes scientists with a broad range of expertise in computational, theoretical, and experimental plasma science, applied mathematics, computer and computational science, and software engineering. The FSP planning team is expected to complete its design report by the end of FY 2010, which will then undergo an independent review.

In FY 2011 the increase in funding will allow FES to start implementing the plan developed by the FSP planning team. The FSP research team will begin to develop the scientific software deliverables identified and prioritized during the two-year planning study and take the first steps toward the verification and validation of these components.

General Plasma Science	**14,497**	**14,193**	**14,193**

The General Plasma Science program is directed toward basic plasma science and engineering research. This research strengthens the fundamental underpinnings of the discipline of plasma physics that complements burning plasma science and reaches beyond into many basic and applied physics areas. Principal investigators at universities, laboratories, and private industry carry out the research. A critically important element is the education of plasma physicists. Continuing elements of this program are the NSF/DOE Partnership in Basic Plasma Science and Engineering, the Plasma Science Centers (PSCs), the General Plasma Science program at the DOE laboratories, and basic plasma physics user facilities at laboratories and universities (sharing costs with NSF where appropriate). The PSCs perform plasma science research in areas of such wide scope and complexity that it would not be feasible for individual investigators or small groups to make significant progress. Atomic and molecular data for fusion will continue to be generated and distributed through openly available databases. FES will continue to share the cost with NSF of the multi-institutional plasma physics Frontier Center started in FY 2003 and renewed by NSF for five years in FY 2008. In FY 2009, the PSCs program was renewed following an intensive merit review process. Of the seven applications for PSC funding in FY 2009, one center was selected for funding with regular appropriations and two additional centers were selected with one fully funded for five years and the second funded for approximately three years using Recovery Act funding. In FY 2011, the third year of funding is provided for the PSC funded through regular appropriations.

SBIR/STTR	**0**	**8,382**	**8,137**

In FY 2009, $7,171,000 and $861,000 were transferred to the congressionally mandated Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, respectively. The FY 2010 and FY 2011 amounts are the estimated requirements for the continuation of these programs.

Total, Science	**163,479**	**182,092**	**185,940**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Tokamak Experimental Research	
▪ **DIII-D Research**	
The decrease in funding will shift resources to facility operations to support the completion of facility upgrade activities but still provide sufficient research support and analysis for the planned 14 weeks of experiments.	-900
▪ **Diagnostics**	
The increase in funding is for magnetic fusion energy research.	+8
▪ **Other**	
In the FY 2010 appropriation, FES received an overall increase of $5,000,000 for a total of $426,000,000. This funding element includes the $5,000,000 increase until it can be distributed among priority activities within the FES Science subprogram. Following the distribution of the $5,000,000 in FY 2010, the remaining increase of $1,228,000 will support continuation of Early Career and other post doctoral activities. FES support for new graduate fellowships in fusion science is completed in FY 2010 with the initiation of the DOE Office of Science Fellowship program funded within the Workforce Development for Teachers and Scientists program.	-3,504
Total, Tokamak Experimental Research	**-4,396**
Alternative Concept Experimental Research	
▪ **High Energy Density Laboratory Plasmas (HEDLP)**	
Increase will allow for an expansion of research activities supported by the HEDLP initiative, which was started in FY 2009.	+6,489
Advanced Fusion Simulations	
▪ **Fusion Simulation Program (FSP)**	
The increase will allow FES to start the ramp-up of the Fusion Simulation Program (FSP) funding as it transitions from the planning phase to the full program.	+2,000
SBIR/STTR	
The support for SBIR/STTR is funded at the mandated level.	-245
Total Funding Change, Science	**+3,848**

Facility Operations

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Facility Operations			
DIII-D	36,456	37,480	39,751
Alcator C-Mod	15,724	17,434	18,457
NSTX	22,536	22,150	22,024
NSTX Upgrade (MIE)	5,235	6,550	7,685
Other, GPE and GPP	3,698	2,103	2,103
U.S. Contributions to ITER (MIE TPC)	124,000	135,000	80,000
Total, Facility Operations	207,649	220,717	170,020

Description

The mission of the Facility Operations subprogram is to provide for the operation, maintenance, and minor modifications of the major fusion research facilities (Alcator C-Mod, DIII-D, and NSTX), to carry out major upgrades to existing facilities, and to construct new facilities such as ITER. Periodic facility reviews are used to ensure that the facilities are operated efficiently and in a safe and environmentally sound manner. The balance between operations, maintenance, and upgrades is judiciously adjusted to ensure safe operation of each facility; provide modern experimental tools such as heating, fueling, and exhaust systems; and provide the operating time to meet the needs of scientific collaborators.

The major FES facilities enable U.S. scientists from universities, laboratories, and industry, as well as visiting foreign scientists, to conduct world-class research funded through the Science and Enabling R&D subprograms. Upgrades of the major fusion facilities, such as installation of new diagnostics, and execution of new projects, such as ITER, help to keep U.S. scientists at the forefront of plasma and fusion research.

The *DIII-D* tokamak at General Atomics in San Diego, California is the largest magnetic fusion facility in the United States. DIII-D provides for considerable experimental flexibility and has extensive diagnostic instrumentation to measure the properties of high temperature plasmas. It also has unique capabilities to shape the plasma and provide feedback control of error fields that, in turn, affect particle transport and the stability of the plasma. The extensive tokamak database from DIII-D has provided the major physics input to the ITER design.

Alcator C-Mod at MIT is the only tokamak in the world operating at and above the ITER design magnetic field and plasma densities, and it produces the highest pressure tokamak plasma in the world, approaching pressures expected in ITER. It is also unique in the use of all-metal walls to accommodate high power densities. Because of these characteristics, C-Mod is particularly well suited to examine plasma regimes that are highly relevant to ITER.

NSTX is an innovative magnetic fusion device at PPPL using the spherical torus confinement configuration. A major advantage of this configuration is the ability to confine a higher plasma pressure for a given magnetic field strength, which could enable the development of smaller, more economical fusion research facilities.

ITER is an important step between today's facilities designed to study plasma physics and a demonstration fusion power plant. It will be the only magnetic fusion facility in the foreseeable future to achieve burning plasmas, which is essential to demonstrate the scientific feasibility of fusion energy, and study its underlying physics. An international collaboration of scientists and engineers led to the design of this burning plasma physics experiment. Project partners are China, the European Union (EU), India, Japan, Russia, South Korea, and the United States. ITER is presently under construction in Cadarache, France.

Selected FY 2009 Accomplishments

- *DIII-D:* The installation of an additional power supply for the electron cyclotron heating system permitted the simultaneous operation of six long pulse, high power microwave tubes for the first time. The completed six tube system resulted in a DIII-D record of 13 megajoules of microwave energy injection into a plasma.
- *Alcator C-Mod:* An extensive set of new divertor and limiter heat-flux diagnostics was installed during C-Mod's recent maintenance shutdown, which is providing key information on energy deposition to main-chamber limiter and divertor surfaces and their relationship to upstream plasma parameters. The new diagnostics are providing critical data to advance our understanding of plasma-wall interaction physics in the unique power density regime in which C-Mod operates.
- *NSTX:* Using dual lithium evaporators to provide complete toroidal coverage of lithium to the lower divertor structure, the NSTX team has achieved plasma performance significantly higher than with one lithium evaporator. In addition, high-performance operation with no between-shot helium glow discharge cleaning is now possible, thus increasing the achievable shot-rate by more than 20%.
- *ITER Test Blanket Module Experiments on DIII-D*: To address a concern that the ferromagnetic materials in the structure of proposed ITER Test Blanket Modules (TBMs) might have a detrimental effect on the performance of ITER, DIII-D researchers have designed and installed a mockup module that can simulate the expected fields in ITER by varying currents in coils in the mockup module. The coils can produce fields that will be up to approximately three times the equivalent perturbation that would be produced by the TBMs in ITER. An international research team representing most of the ITER parties will carry out a series of experiments in FY 2010 to determine the effect that the localized non-resonant fields from the TBM mockup have on the DIII-D plasma.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
DIII-D	**36,456**	**37,480**	**39,751**

To carry out the research funded in the Science subprogram, support is provided for operation, maintenance, and improvement of the DIII-D facility and its auxiliary systems. The DIII-D program will complete 17 weeks of FY 2010 experimental operations (including three weeks using Recovery Act funding) in April 2010 prior to a year-long shutdown for facility modifications. The primary modifications will be to move one of the neutral beam lines for off-axis power injection, installation of internal control coils on the tokamak center post for investigation of plasma edge instabilities, and diagnostics improvements. The Recovery Act funding for the DIII-D Upgrades provided for enhanced diagnostics systems and additional electron cyclotron heating. The FY 2011 experimental operations will then start in April 2011 with plans for 14 weeks of single-shift operations. Operations will continue to support experiments addressing ITER design and operations issues and developing the

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

advanced tokamak concept for fusion energy. Experiments in FY 2011 will take advantage of the recently completed off-axis neutral beam and center post coil systems.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	559	N/A	N/A
Planned Operating Hours[a]	520	560	560
Optimal Hours	1,000	1,000	1,000
Percent of Optimal Hours	55.9%	56.0%	56.0%
Unscheduled Downtime	85	N/A	N/A
Number of Users	220	235	235

Alcator C-Mod	**15,724**	**17,434**	**18,457**

Support is provided for operation, maintenance, minor upgrades, and improvement of the Alcator C-Mod facility and its auxiliary systems, including completing and installing a second advanced 4-strap ion cyclotron radio frequency antenna, returning to full system capability (8 MW source, at least 6 MW coupled), continued planning for a second advanced lower hybrid launcher (FY 2011 installation), and the design of a high temperature tungsten divertor. In FY 2010, Alcator C-Mod will be operated for 18 weeks, which includes five weeks using Recovery Act funding, focusing on ITER design and operations issues and addressing high field and density issues. The Recovery Act funding for the Alcator C-Mod Upgrades enabled the improvements to the facility's auxiliary heating and diagnostic systems. In FY 2011, Alcator C-Mod will operate for 15 weeks.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	291	N/A	N/A
Planned Operating Hours[a]	288	416	480
Optimal Hours	800	800	800
Percent of Optimal Hours	36.4%	52.0%	60.0%
Unscheduled Downtime	8	N/A	N/A
Number of Users	182	195	200

NSTX	**22,536**	**22,150**	**22,024**

Support is provided for operation, maintenance, and a few facility and diagnostic upgrades on NSTX, including an edge ultra-soft x-ray array, a divertor spectrometer, beam emission spectroscopy for measuring ion-scale turbulence, and an ion flow measurement diagnostic. In FY 2009, NSTX operated for 16.8 weeks, which included 5.8 weeks using Recovery Act funding. In FY 2010, 15 weeks of operation are planned, including one week using Recovery Act funding. The Recovery Act funding for NSTX enabled the facility and diagnostic upgrades. In FY 2011, there is funding for 14 weeks of operation to explore issues of sustained spherical torus (ST) operation and study ST confinement at high fields relevant to evaluating the science base for high-heat flux and plasma nuclear science

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[a] Planned hours do not include Recovery Act supported operations in FY 2009 and FY2010.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

initiatives. In FY 2011, NSTX will fully exploit new capabilities added in FY 2009 such as the liquid lithium divertor and the upgraded high harmonic fast wave antenna.

	FY 2009	FY 2010	FY 2011
Achieved Operating Hours	440	N/A	N/A
Planned Operating Hours[a]	440	560	560
Optimal Hours	1,000	1,000	1,000
Percent of Optimal Hours	44.0%	56.0%	56.0%
Unscheduled Downtime	0	N/A	N/A
Number of Users	140	145	145

NSTX Upgrade (MIE)	**5,235**	**6,550**	**7,685**

Support is provided to begin conceptual design work for a major upgrade of NSTX to keep its world-leading status. A new centerstack magnet assembly that will double the magnetic field and a second neutral beam line that will double the plasma heating power are both being considered. The proposed funding and Critical Decision (CD) schedule for these activities will be refined in FY 2010. A final decision as to whether to carry out both upgrades in parallel or in series will be made at CD-2.

Other, GPE, and GPP	**3,698**	**2,103**	**2,103**

Funding for general plant projects (GPP) and general purpose equipment (GPE) provides support for general infrastructure repairs and upgrades for the PPPL site based upon quantitative analysis of safety requirements, equipment reliability, and research needs. Recovery Act funding supports a major upgrade to PPPL's electrical power distribution system, including 138 kilovolt switch gear, transformers, and associated circuit breakers.

U.S. Contributions to ITER Project (MIE)	**124,000**	**135,000**	**80,000**

Background: The U.S. ITER Project is the U.S. share of a seven-member international collaboration to design and build a first-of-a-kind international research facility in Cadarache, France to demonstrate the scientific feasibility of fusion energy. The U.S. ITER Project scope consists of delivering hardware components, personnel, and funds to the ITER Organization (IO). The legal framework for construction, operation, deactivation, and decommissioning is contained in the *Agreement on the Establishment of the ITER International Fusion Energy Organization for the Joint Implementation of the ITER Project* (or the JIA), which entered into force in October 2007 for a period of 35 years.

While significant technical progress has been made with large fusion experiments around the world, most of which were constructed in the 1980s, it has long been obvious that a larger and more powerful magnetic confinement device would be needed to create the physical conditions expected in a fusion power plant (i.e., a sustained "burning plasma" comprised of hot ionized deuterium and tritium gas) and to demonstrate its feasibility. The idea to cooperatively design and build such a device originated from the Geneva Summit in November 1985; the U.S. participated in the initial design activity and after a hiatus, the U.S. joined the ITER negotiations in early 2003.

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[a] Planned hours do not include Recovery Act supported operations in FY 2009 and FY2010.

International ITER Project Status: The IO, located at Cadarache, has been established as an independent international legal entity comprised of personnel from all of the Members. The IO is led by a Director General who is appointed by the ITER Council, which serves as ITER's executive governing board. The Council comprises representatives from all the Members. Like all non-host Members, the U.S. share for ITER's construction is 1/11 (9.09%) of the total value estimate—roughly 80% will be in-kind components manufactured by U.S. industry—and beyond that, the U.S. has agreed to fund 13% of the cost for operation, deactivation, and decommissioning. As the Host, the EU is obligated to provide 5/11 (45.45%) of ITER's construction value. The JIA identifies the hardware procurement allocations among the seven Members based on this cost sharing arrangement. Starting from a 'green field' site in 2006, the ITER enterprise at Cadarache had staffed up to about two thirds of its full complement of 600 personnel by the end of 2009.

An international design review in 2007 recommended several important ITER design improvements and identified some missing items of scope, such as certain test facilities and a number of spare parts. Although the JIA included a goal for construction completion and first plasma to be achieved in 2016, this has proven to be unrealistic. Together with other factors, these developments have increased the estimate for ITER's construction cost. The IO's most urgent tasks now are to complete work on the overall ITER design and systems engineering, and to establish realistic technical, schedule, and cost baselines. The ITER Council has asked the IO to prepare a baseline proposal for the Council to review and approve by mid-2010. The U.S. will continue to emphasize the importance of completing these efforts as soon as possible and provide support as needed.

U.S. ITER Project Status: The main cost risk to the U.S. ITER Project is the slow rate of progress by the IO and some Members' Domestic Agencies who are responsible for critical path hardware components, which has delayed the construction schedule. Next, there remains some ambiguity over the effect of EU/French nuclear regulatory requirements on U.S. hardware designs. Development of a realistic ITER baseline schedule and cost estimate is ongoing. Once the baseline has been established and approved by the Council, the USIPO will be able to develop schedule and cost baselines for the U.S. ITER Project scope in preparation for CD-2, Approve Performance Baselines. CD-2 is currently projected to occur in late FY 2011.

Estimated ITER TPC Range: The TPC range approved at CD-1 accounts for the magnitude of cost risks that were identified at the time the range was developed in late 2007. The sources of potential cost growth can be categorized as follows: actions taken by the ITER Council and the IO, external factors outside of the ITER project, and design maturity.

Among the aspects under the IO's purview, the principal cost drivers are the overall project schedule, design changes and other actions affecting hardware scope and manufacturing costs, and French and EU licensing/regulatory requirements. The IO is continuing to develop an integrated baseline schedule for the construction phase that includes detailed inputs from the seven Members. Likewise, there are several changes to the reference design, some of which may increase the U.S. ITER TPC.

External factors include changes in Dollar/Euro exchange rates, escalation rates, commodity prices, and market conditions for hardware procurement. The JIA requires funding contributions from the Members to be made in Euros, which has already increased U.S. ITER Project costs due to less favorable Dollar-Euro exchange rates. Prices for raw materials used in manufacturing U.S.-supplied hardware have also been steadily increasing. This remains a significant long-term concern.

Finally, the reference design for ITER is not complete in certain areas such as the blanket first wall and shield system. This means that there could be adverse cost impacts as the design is finalized prior to fabrication. A Test Blanket Module (TBM) program has been established to demonstrate a key element of fusion technology, namely the breeding of tritium for a closed fuel cycle in a fusion power plant. While not part of the construction scope of ITER, it will have near-term financial implications since certain modifications to the currently designed ITER civil infrastructure must be made to accommodate TBMs. The U.S. share of these modifications is expected to be under $10,000,000 and will be funded by the U.S. ITER Project.

All of these risks were previously evaluated to develop a TPC range for CD-1. It was determined that the bottom of the range should be set at $1.45 billion, which included a reasonable contingency amount (equal to 27 percent of the hardware cost). The difference between $1.45 billion and the top end of the TPC range, $2.2 billion, essentially provides additional contingency for known risks in the above categories as well as an amount for unidentified risks. However, the approved TPC range presumed a much more aggressive schedule than has evolved thus far.

ITER Financial Schedule Total Project Cost (TPC)[a]

(budget authority in thousands)

Fiscal Year	Total Estimated Cost	Other Project Costs	Total Project Costs
2006	15,866	3,449	19,315
2007	42,000	18,000	60,000
2008	22,500	3,570	26,070
2009	109,000	15,000	124,000
2010	115,000	20,000	135,000
2011	75,000	5,000	80,000
Outyears	TBD	TBD	TBD

In FY 2010, funds are being used to perform a variety of design, R&D, and long-lead procurement activities for the U.S. hardware contributions to ITER construction. For the two largest elements of U.S. scope, the central solenoid magnet system and the tokamak cooling water system, these include industrial design and manufacturing R&D efforts as well as long-lead procurements of materials. Long-lead procurement of toroidal field magnet conductors from industrial vendors is also continuing. In other areas of U.S. responsibility, design and R&D is continuing for the blanket first wall and shield modules, fueling pellet injector, tokamak exhaust processing system, ion and electron cyclotron heating transmission lines, steady-state electric power system, vacuum pumping system, and diagnostics. The U.S. is continuing to provide conceptual design and cost estimating services to the IO for the ITER in-vessel coil system. The balance of funds will be used to support the USIPO, provide a small number of U.S. secondees to work on the IO staff, and furnish prescribed funding contributions to the IO.

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[a] A complete baseline funding profile, including the outyears, will be established at CD-2, which is anticipated to be in FY 2011.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

The $80,000,000 requested for the U.S. ITER Project in FY 2011 is a reflection of the pace of ITER construction as of the end of 2009. The Administration is engaged in a range of initiatives to implement management reforms at the IO and accelerate ITER construction with the goal of minimizing the overall cost of the Construction Phase for the U.S. and the other ITER Members.

The FY 2011 funding request will be used to make progress on all of the design, R&D, and long-lead procurement activities described above for the U.S. hardware contribution, albeit at a reduced rate. Emphasis will continue to be given to industrial involvement in completing design work in preparation for subsequent large-scale fabrication activities. Toroidal field magnet conductor production will be largely completed. The U.S. effort on the in-vessel coils will be handed over to the IO, which will be responsible for completing preliminary design, prototyping, final design, as well as fabrication. The balance of funds will be used to support the USIPO, provide a small number of U.S. secondees to work on the IO staff, and furnish prescribed funding contributions to the IO.

ITER Related Annual Funding Requirements: The current estimate in the table below incorporates the terms of the JIA on cost sharing during operations, deactivation and decommissioning. Specifically, it considers the procedure for converting currencies into Euros and the 20-year period of annual contributions to the decommissioning fund in conjunction with ITER operations.

(dollars in thousands)

	Current Estimate	Previous Estimate
FY 2015–FY 2034[a]		
U.S. share of annual facility operating costs including commissioning, maintenance, repair, utilities, power, fuel, improvements, and annual contribution to decommissioning fund for the period 2015 to 2034. Estimate is in 2015 dollars.	80,000	80,000
FY 2035–FY 2039		
U.S. share of the annual cost of deactivation of ITER facility for the period 2035–2039. Estimate is in 2037 dollars.	25,000	25,000

Total, Facility Operations	**207,649**	**220,717**	**170,020**

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[a] These estimates will be updated to reflect a more realistic start date for the ITER Operations Phase once the ITER Council has approved a baseline schedule for the Construction Phase.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
DIII-D	
The increase in funding for FY 2011 will allow for completion of the facility upgrades begun in FY 2010 as part of the long torus opening activity. It will also support 14 weeks of single-shift operations.	+2,271
Alcator C-Mod	
The increase in funding for FY 2011 will allow completing a new antenna for radio frequency heating experiments and installation of a second lower hybrid launcher. It will enable design of a tungsten divertor relevant to a future demonstration reactor and will support 15 weeks of operation.	+1,023
NSTX	
The decrease in funding for the NSTX Facility is applied to the increase for the NSTX Upgrade MIE project. This budget will support 14 run weeks of plasma operation.	-126
NSTX Upgrade (MIE)	
The increase will provide for continued work on two possible enhancements to the NSTX Facility. An upgrade to the magnet system, including the central solenoid, is designed to permit higher plasma currents and magnetic fields. The additional neutral beam heating power is designed to enable control of the plasma stability by modifying the plasma current. Completing both upgrades would enable higher plasma pressures to be obtained.	+1,135
U.S. Contributions to ITER Project (MIE)	
U.S. Contributions to ITER MIE funding is decreased by $55,000,000 to match the Administration's late 2009 estimation of the pace of the ITER project.	-55,000
Total Funding Change, Facility Operations	**-50,697**

Enabling R&D

Funding Schedule by Activity

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Enabling R&D			
Engineering Research	18,573	17,974	18,311
Materials Research	4,817	5,217	5,729
Total, Enabling R&D	23,390	23,191	24,040

Description

The Enabling R&D subprogram helps the Science subprogram address its scientific challenges by developing and continually improving the hardware, materials, and technology that are incorporated into existing fusion research facilities, thereby enabling these facilities to achieve higher levels of performance. Enabling R&D also supports the development of new hardware, materials, and technology that are incorporated into the design of next generation facilities, thereby increasing confidence that the predicted performance of these new facilities will be achieved.

Selected FY 2009 Accomplishments

- *New Disruption Mitigation Tool Successfully Tested on DIII-D:* Disruptions are the sudden, uncontrolled termination of the plasma that can potentially damage the plasma chamber from sudden thermal loads and high magnetic forces. A new technique has been developed to mitigate these effects by injecting a solid hydrogen pellet nearly the size of a wine cork into the disrupting plasma. The pellet is fired by a pneumatic gun and shattered by hitting a metal plate just before entering the plasma to produce a spray of hydrogen that quickly dissipates the plasma energy in approximately 1/1000th of a second before any plasma chamber damage can take place. A new system using this technique has been installed on DIII-D and has been shown to control the rapid termination of high performance plasmas and reduce thermal loads and forces. This technique can potentially be employed on ITER to prevent any disruptions from reducing machine availability for physics experiments.
- *Understanding plasma material interactions for ITER:* A burning plasma creates a harsh environment that challenges the materials inside the plasma chamber. During ITER operation, we must understand the very complex mechanistic effects of a burning plasma on the materials so as to optimize the design as well as ensure safe operating scenarios for the device. As part of a U.S.-Japan collaboration, which is focused on plasma chamber issues, experiments are being conducted at the University of California at San Diego to simulate fusion-type plasmas to better understand these complicated phenomena. These experiments show that helium, a byproduct of the deuterium-tritium fusion reaction, has a beneficial effect of reducing surface blistering in tungsten, which will be used as a plasma facing material in ITER. This beneficial effect is caused by nano-sized high density helium bubbles created in the near-surface region of the tungsten acting as a diffusion barrier. The implication of this result is that tritium uptake in tungsten surfaces, an important safety concern, may be reduced by the presence of helium contained in the plasma interacting with the tungsten surfaces.
- *Developing materials for use in the fusion environment:* Significant progress has been made on a new class of structural materials known as nanocomposited ferritic alloys. These materials contain an ultrahigh density of nanometer-scale particles that impart excellent high-temperature strength,

radiation damage resistance, and the potential to tolerate the high-levels of helium produced in the fusion neutron environment. Recent modeling has revealed that the basic strengthening mechanism in these alloys is due to the unique crystal structure of the nanometer-scale particles. Novel experiments performed in the High Flux Isotope Reactor have also demonstrated the capability of these materials to manage fusion-relevant helium production through the formation of numerous, very fine-scale bubbles on the nanoparticles.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Engineering Research	**18,573**	**17,974**	**18,311**

The Engineering Research element addresses the breadth and diversity of domestic interests in enabling R&D for magnetic fusion systems as well as international collaborations with emphasis on heating, fueling, plasma chamber, safety research, and surface protection technologies. While much of the effort is focused on current devices, an increasing amount of the research is oriented toward the technology needs or issues that will be faced in future experiments, including ITER. An example is to understand scientifically what is occurring in a burning plasma with material erosion and redeposition within the fusion chamber caused by this harsh environment and what effect it can have on the plasma and ITER operation. In addition to providing the tools that help accomplish the experimental research, a part of this element also conducts system studies of the most scientifically challenging concepts for fusion research facilities that may be needed in the future as well as identifying critical scientific issues and missions for the next stage in the FES program. Finally, analysis and studies of critical scientific and technological issues are supported, the results of which will provide guidance for optimizing future experimental approaches and for understanding the implications of fusion research on applications of fusion.

	FY 2009	FY 2010	FY 2011
▪ **Plasma Technology**	**14,471**	**13,651**	**13,651**

Plasma Technology efforts will focus resources on developing enabling technologies for current and future machines, both domestically and internationally, and on addressing potential ITER operational issues. In addition, the collaborative program on plasma facing and blanket materials for use in future facilities, Tritium Irradiation Thermofluid American-Japanese Network (TITAN), will be continued.

In FY 2011, the following specific activities will be supported:

- Continue the experimental studies and modeling activities of tungsten-carbon-beryllium mixed materials layer formation and redeposition in the University of California at San Diego experimental facility and in the Tritium Plasma Experiment at Idaho National Laboratory (INL). Results will be applied to evaluate tritium accumulation in plasma facing components that will occur during ITER operation.
- Continue a series of material science experiments under the TITAN cost-sharing collaboration with Japan in the Safety and Tritium Applied Research Facility at INL to resolve key issues of tritium behavior in materials proposed for use in fusion systems.

Research will also be conducted on plasma facing components, heating and fueling technologies, and blanket concepts that could be tested in ITER. In addition, this category funds research in safety and plasma-surface interaction and modeling to address potential issues that could be encountered during operation of ITER or future devices.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
- **Advanced Design**	**4,102**	**4,323**	**4,660**

In FY 2011 this effort will continue to focus on system studies by a team from the fusion research community with a wealth of experience in fusion science, technology, and facilities. The team is known for its objective approach and its ability to develop highly innovative solutions. In the past the team has conducted studies of various types of fusion devices to help the program identify the R&D necessary to move the program forward.

Using this existing team and other resources, FES will initiate a series of strategic planning/scoping studies as follow-on to the June 2009 Research Needs Workshop on the Magnetic Fusion Energy Sciences part of the program. These studies will help identify possible approaches for the next stage in the U.S. fusion research program in the ITER era. The long-term objective is to identify potential initiatives and facilities that may be pursued at the pre-conceptual level.

	FY 2009	FY 2010	FY 2011
Materials Research	**4,817**	**5,217**	**5,729**

The Materials Research element focuses on the key science issues of materials for practical and environmentally attractive uses in fusion research and future facilities. This element uses both experimental and modeling activities which make it more effective at using and leveraging the substantial work on nanosystems and computational materials science being funded by other programs. The long-term goal of this element is to develop experimentally validated predictive and analytical tools that can lead the way to nanoscale design of advanced fusion materials with superior performance and lifetimes.

The FY 2011 request will maintain and modestly grow a Materials Research program that addresses material needs for nearer and longer term fusion devices. The funding will be used for both modeling and experimental activities aimed at the science of materials behavior in fusion environments, including research on candidate materials for the structural and plasma facing elements of fusion chambers. Through a variety of cost-shared international collaborations, this element conducts irradiation testing of candidate fusion materials in the simulated fusion environments of fission reactors to provide data for validating and guiding the development of models for the effects of neutron bombardment on the microstructural evolution, damage accumulation, and property changes of fusion materials.

	FY 2009	FY 2010	FY 2011
Total, Enabling R&D	**23,390**	**23,191**	**24,040**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Engineering Research	
- **Advanced Design**	
The increase will support strategic planning/scoping studies on issues and topics identified during the Research Needs Workshops. The studies will help identify possible approaches for the next steps in the U.S. fusion research program.	+337

	FY 2011 vs. FY 2010 ($000)
Materials Research	
The increase will support scientific research on new nano-composited high strength materials.	+512
Total Funding Change, Enabling R&D	**+849**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	273,026	298,646	290,588
Capital Equipment	118,499	125,861	87,919
General Plant Projects	2,993	1,493	1,493
Total, Fusion Energy Sciences	394,518	426,000	380,000

Funding Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	186,869	205,283	209,980
Scientific User Facilities Operations	74,716	77,064	80,232
Major Items of Equipment	129,235	141,550	87,685
Other (GPP, GPE and Infrastructure)	3,698	2,103	2,103
Total, Fusion Energy Sciences	394,518	426,000	380,000

Scientific User Facilities Operations and Research

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
DIII-D			
Operations	36,456	37,480	39,751
Facility Research	25,740	27,504	26,604
Total DIII-D	62,196	64,984	66,355
Alcator C-Mod			
Operations	15,724	17,434	18,457
Facility Research	9,002	9,045	9,045
Total Alcator C-Mod	24,726	26,479	27,502
NSTX			
Operations	22,536	22,150	22,024
Facility Research	17,104	17,549	17,549
Total NSTX	39,640	39,699	39,573

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Scientific User Facilities Operations and Research			
Operations	74,716	77,064	80,232
Facility Research	51,846	54,098	53,198
Total, Scientific User Facilities Operations and Research	126,562	131,162	133,430

Facility Users and Hours

	FY 2009	FY 2010	FY 2011
DIII-D National Fusion Facility			
Achieved Operating Hours	559	N/A	N/A
Planned Operating Hours[a]	520	560	560
Optimal Hours	1,000	1,000	1,000
Percent of Optimal Hours	55.9%	56%	56%
Unscheduled Downtime	85	N/A	N/A
Number of Users	220	235	235
Alcator C-Mod			
Achieved Operating Hours	291	N/A	N/A
Planned Operating Hours[a]	288	416	480
Optimal Hours	800	800	800
Percent of Optimal Hours	36.4%	52%	60%
Unscheduled Downtime	8	N/A	N/A
Number of Users	182	195	200
National Spherical Torus Experiment			
Achieved Operating Hours	440	N/A	N/A
Planned Operating Hours[a]	440	560	560
Optimal Hours	1,000	1,000	1,000
Percent of Optimal Hours	44.0%	56%	56%
Unscheduled Downtime	0	N/A	N/A
Number of Users	140	145	145

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[a] Planned hours do not include Recovery Act supported operations in FY 2009 and FY2010.

	FY 2009	FY 2010	FY 2011
Total, Facilities Users and Hours			
Achieved Operating Hours	1,290	N/A	N/A
Planned Operating Hours[a]	1,248	1,536	1,600
Optimal Hours	2,800	2,800	2,800
Percent of Optimal Hours	46.1%	54.9%	57.1%
Unscheduled Downtime	93	N/A	N/A
Number of Users	542	575	580

Major Items of Equipment

(dollars in thousands)

	Prior Years	FY 2009	FY 2010	FY 2011	Outyears	Total
MIEs						
NSTX Upgrade						
TEC	0	0	5,550	7,685	TBD	TBD
OPC	0	5,235	1,000	0	TBD	TBD
TPC	0	5,235	6,550	7,685	TBD	TBD
ITER						
TEC	82,366	109,000	115,000	75,000	TBD	TBD
OPC	23,019	15,000	20,000	5,000	TBD	TBD
TPC	105,385	124,000	135,000	80,000	TBD	TBD
Total MIEs						
TEC		109,000	120,550	82,685	TBD	TBD
OPC		20,235	21,000	5,000	TBD	TBD
TPC		129,235	141,550	87,685	TBD	TBD

Facility Operations MIEs:

- ***National Spherical Torus Experiment Upgrade Major Item of Equipment Project***

  The NSTX Upgrade Project was initiated in FY 2009 to support major upgrades at NSTX to keep its world-leading status. As presently envisioned, this project will add a new centerstack magnet assembly that will double the magnetic field, and a second neutral beam (NB) line that will double the NB power available to heat the plasma. CD-0 (Approve Mission Need) was completed on February 23, 2009. The CD-1 Independent Project Review was completed in December 2009. Upon completion of the Departmental review and approval of CD-1, anticipated in the second quarter FY 2010, more definition on the project's scope, schedule, and cost will become available. A decision on the baseline scope, schedule, and cost of this project will be made at CD-2.

- ***U.S. Contributions to ITER***

  The objective of the U.S. ITER Project is to deliver the U.S. share of the hardware components, personnel, and funding contributions (in Euros) to the ITER Organization (IO) for the ITER construction phase per the terms of the ITER Joint Implementation Agreement. The U.S. ITER Project is being managed by the U.S. ITER Project Office (USIPO), located at Oak Ridge National Laboratory (ORNL). ORNL serves as the prime contractor to DOE, working with its partners Princeton Plasma Physics Laboratory and Savannah River National Laboratory. Each laboratory has been assigned a well-defined portion of the project's scope that takes advantage of their respective technical strengths. DOE serves as the U.S. Domestic Agency for ITER, and under its direction, the USIPO has responsibility for planning, managing, and delivering the entire scope of the U.S. ITER Project. All U.S. ITER Project activities are being overseen by a DOE Federal Project Director at the DOE Oak Ridge Office. As the design agent and eventual operator/owner of the ITER facility, the IO is responsible for specifying top level hardware design requirements and delivery schedules.

The U.S. ITER Project was formally initiated in July 2005 when Critical Decision-0 (CD-0), Mission Need, was approved by the DOE Senior Acquisition Executive, and the first year of project funding was FY 2006. CD-1, Alternative Selection and Cost Range (including authorization for long-lead procurements), was subsequently approved in January 2008. This set the Total Project Cost (TPC) range at $1.45 to $2.2 billion (as spent). A schedule range for U.S. ITER Project completion (CD-4) was set at FY 2014–2017. Current efforts are focused on completing U.S. hardware component designs and supporting R&D, and assisting the IO with establishing a functionally mature project management organization.

The $80,000,000 requested for the U.S. ITER Project in FY 2011 is a reflection of the pace of ITER construction as of the end of 2009. The Administration is engaged in a range of initiatives to implement management reforms at the IO and accelerate ITER construction with the goal of minimizing the overall cost of the construction phase for the U.S. and the other ITER Members.

Scientific Employment

	FY 2009 actual	FY 2010 estimate	FY 2011 estimate
# University Grants	305	246	320
# Laboratory Projects	158	167	166
# Permanent Ph.D's (FTEs)	725	723	763
# Postdoctoral Associates (FTEs)	113	113	118
# Graduate Students (FTEs)	327	327	344
# Ph.D.'s awarded	37	42	44

High Energy Physics

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
High Energy Physics				
Proton Accelerator-Based Physics	401,368	+107,990	434,167	439,262
Electron Accelerator-Based Physics	32,030	+1,400	27,427	24,707
Non-Accelerator Physics	101,138	+4,445	99,625	88,539
Theoretical Physics	66,148	+5,975	66,962	69,524
Advanced Technology R&D	175,184	+112,580	182,302	189,968
Subtotal, High Energy Physics	775,868	+232,390	810,483	812,000
Construction	0	0	0	17,000
Total, High Energy Physics	775,868[b]	+232,390	810,483	829,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The High Energy Physics (HEP) program's mission is to understand how the universe works at its most fundamental level, which is done by discovering the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time.

Background

Research in high energy physics, often called particle physics, has led to a profound understanding of the physical laws that govern matter, energy, space, and time. This understanding has been formulated in the Standard Model of particle physics, first established in the 1970s, which successfully describes all known behavior of particles and forces, often to very high precision. Nevertheless, the Standard Model is understood to be incomplete. The model fails at extremely high energies—energies just now being created in particle accelerators—and describes only a small fraction of the matter and energy filling the universe. Data have revealed that only about 5% of the universe is made of the normal, visible matter described by the Standard Model. The remaining 95% of the universe consists of matter and energy whose fundamental nature remains a mystery.

A world-wide program of particle physics research is underway to explore what lies beyond the Standard Model. To this end, the HEP supports a program focused on three scientific frontiers:

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] Total is reduced by $19,858,000: $17,730,000 of which was transferred to the Small Business Innovation Research (SBIR) program and $2,128,000 of which was transferred to the Small Business Technology Transfer (STTR) program.

- *The Energy Frontier,* where powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces;
- *The Intensity Frontier,* where intense particle beams and highly sensitive detectors are used to pursue alternate pathways to investigate fundamental forces and particle interactions by studying events that occur rarely in nature; and
- *The Cosmic Frontier,* where ground and space-based experiments and telescopes are used to make measurements that will offer new insight and information about the nature of dark matter and dark energy to understand fundamental particle properties and discover new phenomena.

Together, these three interrelated and complementary discovery frontiers offer the opportunity to answer some of the most basic questions about the world around us, such as:

- *Are there undiscovered principles of nature, such as new symmetries or new physical laws?*

  The laws of quantum physics that describe elementary particles and forces are based on underlying symmetries of nature. Some of these prevail only at very high energies. A possible and theoretically well motivated new symmetry, called supersymmetry, relates particles and forces. It predicts a superpartner for every particle we know. If such superparticles exist, it may be possible to produce the lightest of them with accelerators that operate at the Energy Frontier or infer their existence from rare decays or new phenomena at the Intensity or Cosmic Frontiers.
- *How can we solve the mystery of dark energy?*

  The structure of the universe today is a result of two opposing forces: gravitational attraction and cosmic expansion. For approximately the last six billion years, the universe has been expanding at an accelerating rate due to a mysterious dark energy that overcame gravitational attraction. This energy, which permeates empty space, must have a quantum (or particle) explanation. Dark energy was first discovered in 1998 by HEP-supported researchers (among others); more and other types of data, gathered from the Cosmic Frontier, along with new theoretical ideas, are necessary to make progress in understanding its fundamental nature.
- *Are there extra dimensions of space?*

  String theory is an attempt to unify physics by explaining particles and forces as the vibrations of sub-microscopic strings. String theory requires extra dimensions of space and generally supersymmetry. Accelerators at the Energy Frontier may find evidence for extra dimensions, requiring a completely new paradigm for thinking about the structure of space and time.
- *Do all the forces become one?*

  All the basic forces in the universe could be various manifestations of a single unified force. Unification was Einstein's great, unrealized dream, and advances in string theory give hope of achieving it. The discovery of superpartners or extra dimensions at Energy Frontier accelerators, or hints of them at the Intensity or Cosmic Frontiers, would lend strong support to current ideas about unification.
- *Why are there so many kinds of particles?*

  Three different pairings or "families" of quarks and leptons have been discovered—most of these at DOE national laboratories. Does nature somehow require that there are only three, or are there more? Moreover, the various quarks and leptons have widely different masses and force couplings. These differences suggest there may be an undiscovered explanation that unifies quarks and leptons, just as the discovery of quarks simplified the zoo of composite particle states discovered in the

1960s. Detailed studies that employ Energy Frontier accelerators, as well as precision measurements made at Intensity Frontier facilities, may provide the dramatic insights into this complex puzzle.

- *What is dark matter? How can we make it in the laboratory?*

  Most of the matter in the universe is invisible. We can detect its existence only through its gravitational interactions with normal matter. This dark matter is thought to consist of exotic particles (relics) that have survived since the Big Bang. Experiments are being mounted to try to directly detect these exotic particles, via observations of relic dark matter at the Cosmic Frontier or by producing them at Energy Frontier accelerators that briefly recreate the conditions of the Big Bang.

- *What are neutrinos telling us?*

  Of all the known particles, neutrinos are perhaps the most enigmatic and certainly the most elusive. The three known varieties of neutrinos were all discovered by HEP researchers working at U.S. facilities. Trillions pass through the Earth every second with little or no interaction. Their detection requires intense neutrino sources and large detectors. HEP supports research into fundamental neutrino properties because they can reveal important clues to the unification of forces and the very early history of the universe. Naturally occurring neutrinos are produced by cosmic ray interactions with the Earth's atmosphere, by supernovae, and in the interior of stars. These can be studied at the Cosmic Frontier. They can also be studied at the Intensity Frontier using intense neutrino sources such as nuclear reactors and advanced accelerators.

- *How did the present universe come to be?*

  The universe began with a massive explosion known as the Big Bang, followed by a burst of expansion of space itself. The universe then expanded more slowly and cooled, which allowed the formation of stars, galaxies, and ultimately life. Understanding the very early evolution of the universe will require a breakthrough in physics: the theoretical reconciliation of quantum mechanics with gravity.

- *What happened to the antimatter?*

  The universe appears to contain very little antimatter. Antimatter is continually produced by naturally occurring nuclear reactions only to undergo near immediate annihilation. The Big Bang, however, should have produced equal amounts of both matter and antimatter. This has, to date, been borne out by the study of high-energy collisions in the laboratory. Precise Energy and Intensity Frontier accelerator-based measurements of the subtle asymmetries present in the weak nuclear interaction may shed light on how the present day matter-antimatter asymmetry arose.

Because of the strong connections between the key questions in each area, successfully addressing these questions requires coordinated initiatives at each of the frontiers. The HEP program invents new technologies to answer these questions and to meet the challenges of research at the frontiers. It supports theoretical and experimental studies by individual investigators and large collaborative teams—some who gather and analyze data from accelerator facilities in the U.S. and around the world, and others who develop and deploy ultra-sensitive instruments to detect particles from space and observe astrophysical phenomena that advance our understanding of fundamental particle properties.

Subprograms

The High Energy Physics program is divided into five subprograms that are organized around the tools and facilities they employ (e.g., an electron accelerator or cosmic ray detector) and/or the knowledge and technology they develop (e.g., superconducting radio frequency cavities or computational capabilities):

- The *Proton Accelerator-Based Physics subprogram* exploits two major applications of proton accelerators. Due to the high energy of the collisions at the Tevatron Collider (2 TeV) and the Large Hadron Collider (LHC, 14 TeV), the composite nature of the protons (which are like bean bags full of quarks and gluons), and the fact that the particles interact differently at different energies, these facilities can be used to study a wide variety of scientific issues. Proton accelerators are also capable of producing, by colliding intense proton beams into fixed targets, large samples of other particles (e.g., antiprotons, K mesons, muons, and neutrinos) which can be formed into beams for experiments. The proposed Intensity Frontier program utilizes the high-power proton beam at Fermi National Accelerator Laboratory (Fermilab) to produce intense secondary beams of neutrinos and muons for world-leading experiments.
- The *Electron Accelerator-Based Physics subprogram* utilizes accelerators with high-intensity and ultra-precise electron beams to create and investigate matter at its most basic level. Since electrons are light, point-like particles (unlike protons) they are well-suited to precision measurements of particle properties and exacting beam control. The next-generation Energy Frontier accelerator after the LHC is likely to be a high-energy lepton (electron or perhaps muon) facility that can probe LHC discoveries in detail.
- The *Non-Accelerator Physics subprogram* provides U.S. leadership in the study of those topics in particle physics that cannot be investigated with accelerators, or are best studied by other means. These activities have provided experimental data, new ideas, and techniques complementary to those provided by accelerator-based research. Scientists in this subprogram investigate topics such as dark matter, dark energy, neutrino properties, proton decay, the highest energy gamma rays, and primordial antimatter. Some of the non-accelerator particle sources used in this research are cosmic rays, gamma rays, and neutrinos from astrophysical sources, and neutrinos from commercial nuclear power reactors.
- The *Theoretical Physics subprogram* provides the vision and mathematical framework for understanding and extending the knowledge of particles, forces, space-time, and the universe. This program supports activities that range from detailed calculations of the predictions of the Standard Model to advanced computation and simulations to solve otherwise intractable problems. Theoretical physicists play key roles in determining which experiments to perform and explaining experimental results in terms of underlying theories that describe the interactions of matter, energy, and space-time.
- The *Advanced Technology R&D subprogram* develops the next generation of particle accelerator and detector technologies for the future advancement of high energy physics and other sciences, supporting world-leading research in the physics of particle beams, fundamental advances in particle detection, and R&D on new technologies and research methods appropriate for a broad range of scientific disciplines.

Benefits

Seeking answers to big questions drives basic research. It appeals to our deepest human nature. However, the new technologies created to answer the questions that high energy physicists seek to answer, and the knowledge acquired in their pursuit, also yield substantial benefits of a more tangible nature for society as a whole. The continuous improvement of accelerator and detector technology necessary to pursue high energy physics as well as the scale of the science itself, have had transformative impacts on the Nation's economy, security, and society. HEP, as steward of accelerator science and advanced accelerator technology R&D in the Office of Science, has developed the knowledge and technologies that are the basis for all of the Office of Science major accelerator user facilities. HEP's contributions to the underlying technologies now used in medicine, science, industry, homeland and national security, as well as for workforce training, are also well known. (For more information, visit http://www.science.doe.gov/hep/benefits.)

Looking to the future, HEP's ongoing and future development of accelerator, detector, electronics, and magnet technologies is anticipated to have significant impact in a number of areas: medical treatment and diagnosis—where new, more cost-efficient particle accelerators, detectors, and magnets for cancer treatment and diagnosis should emerge; homeland and national security—where particle accelerators and detectors developed for high energy physics research have the potential for hazardous material detection and non-proliferation verification; industry—where, for example, superconducting cables being developed for next generation magnets for high energy physics research could be used to transmit, with minimal power losses, far more electricity than conventional cables; internet grid development—where the developments of the international grid capability for data analysis of the large detectors at the LHC may result in a paradigm change in the handling of huge data sets; and other scientific fields—where HEP's development of the science and technologies needed for next-generation particle accelerator and detector applications will be transferred and exploited.

An important benefit to the Nation provided by the HEP program is the recruitment and training of a highly motivated, highly trained scientific and technical work force. In particle physics, roughly two thirds of those completing doctoral degrees ultimately pursue careers in diverse sectors of the national economy such as industry, national defense, information technology, medical instrumentation, electronics, communications, and biophysics—where the workforce requires highly developed analytical and technical skills, the ability to work in large teams on complex projects, and the ability to think creatively to solve unique problems.

Program Planning and Management

- *Advisory and Consultative Activities*

  To ensure that resources are allocated to the most scientifically promising experiments, DOE and its national laboratories actively seek external input using a variety of advisory bodies. The High Energy Physics Advisory Panel (HEPAP), jointly chartered by DOE and NSF, provides advice regarding the scientific opportunities and priorities of the national high energy physics research program. HEPAP or one of its subpanels undertakes special studies and planning exercises in response to specific charges from the funding agencies.

  A HEPAP subpanel called the Particle Physics Project Prioritization Panel (P5) was formed to assess and prioritize scientific opportunities and proposed projects. HEPAP subpanels are also convened to review progress and/or future plans in particular research areas or elements of the HEP program. In 2007, P5 was charged to examine the options for mounting a world-class U.S. particle physics program at various funding levels. This HEPAP report[a] was submitted in June 2008 and has provided important input for setting programmatic priorities for the HEP program. Many of the recommendations contained in the report have been implemented, and this budget request in particular emphasizes implementation of the P5 roadmap for the Intensity Frontier.

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[a] The full HEPAP report is available at http://www.science.doe.gov/hep/files/pdfs/P5_Report%2006022008.pdf.

The Astronomy and Astrophysics Advisory Committee (AAAC) now reports on a continuing basis to DOE, as well as to NSF and the National Aeronautics and Space Administration (NASA), with advice on the direction and management of the national astronomy and astrophysics research programs. The AAAC operates similarly to HEPAP and the two advisory bodies have been charged to form joint task forces or subpanels to address research issues at the intersection of high energy physics, astrophysics and astronomy, such as dark energy and dark matter, and the study of high energy cosmic and gamma rays.

The HEP program also instituted a Committee of Visitors (COV) that provides an independent review of its responses to proposals and its research management process, as well as an evaluation of the quality, performance, and relevance of the research portfolio and an assessment of its breadth and balance. The second triennial HEP COV review took place in summer 2007. The 2007 COV report[a] had 18 specific recommendations relating primarily to staffing, grants review and processing, and project management. HEP has completed seven of the recommendations, particularly in regard to staffing; six recommendations are in-process and five are on-going.

- *Review and Oversight*

  The HEP program office reviews and provides oversight for its research portfolio. All university research proposals are subject to a review process to ensure high quality research and relevance to achieving the goals of the national program. Proposals to DOE for grant support are peer-reviewed by external technical experts, following the guidelines established by 10 CFR Part 605.

  Following recommendations of the 2007 COV, HEP implemented a new review process for high energy physics research and basic technology R&D efforts at DOE laboratories. Laboratory high energy physics research or technology R&D groups are peer-reviewed triennially on a rotating basis, using the same criteria established for the university reviews. This is a comparative review that assesses the relative strengths and weaknesses of the various laboratory groups in particular research subfields. In FY 2011, the Accelerator Science and Theoretical Physics subprograms will be reviewed. Laboratory proposals involving significant new research scope are also subject to peer-review by external experts on an *ad hoc* basis.

Basic and Applied R&D Coordination

Many of the broader applications of technology originally developed for HEP research have been serendipitous. In order to provide a more direct connection between fundamental accelerator technology and applications, the HEP program sponsored a workshop in October 2009 to identify the R&D needs of the various users of accelerators who would benefit from future technology R&D initiatives. The workshop focused on the role of accelerators in the nation's efforts in science, medicine, national security, and industry; the opportunities and research challenges for next generation accelerators; the most promising avenues for new or enhanced R&D efforts; and a path forward to stronger coordination between basic and applied research. HEP will use this report to develop a strategic plan for accelerator technology R&D that recognizes its broader societal impacts.

Budget Overview

The HEP program addresses fundamental questions about the nature of the universe by balancing the scientific priorities of the research community with the constraints of the facilities, tools, and resources available. Research facilities for high energy physics generally require significant investments over many years and the coordinated efforts of international teams of scientists and engineers to realize accelerators and detectors that push the frontiers of Energy, Intensity, and Cosmic exploration.

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[a] The 2007 COV report and HEP's response are available at http://www.science.doe.gov/SC-2/COV-HEP/HEP_Reviews.htm.

The HEP program, with input from the scientific community, has developed a long-range plan which maintains a leadership role for the U.S. within this global context. In this plan there is a continuing shift of focus from the operation of the facilities built at the end of the 1990s to the design and construction of new research capabilities, while maintaining a world-leading scientific program and identifying targeted long-range R&D for the future. This strategic plan allows the Nation to play an important role at all three frontiers of particle physics.

The Energy Frontier: The Tevatron Collider at Fermilab continues operations in FY 2011. Its record-breaking performance in delivering data over the last few years means that it will remain competitive with the LHC for significant discoveries during the first few years of LHC operations. The primary scientific goals of the HEP program over the next five years are to enable these discoveries—for example, the Higgs boson and supersymmetric particles—either at the Tevatron or the LHC. First beam collisions at the LHC occurred at the end of 2009 and the first physics run will begin in February 2010. Support for LHC detector operations, maintenance, computing, and R&D is necessary to maintain a U.S. leadership role in the LHC program.

The HEP strategic plan includes U.S. participation in the first phase of the anticipated LHC accelerator and detector upgrades to improve performance and reliability and provide a two-fold increase in the LHC luminosity (a measure of the number of physics interactions per second), which will significantly lower statistical uncertainties and improve the chances of observing rare events. Data from the first phase will guide the choice of the most promising physics to pursue in any future enhancement of LHC accelerator and detector capabilities. Physics results from the LHC will also help guide research and development for a potential next-generation lepton collider.

The Intensity Frontier: The Neutrinos at the Main Injector (NuMI) beamline at Fermilab will operate in its current configuration through FY 2011 for ongoing neutrino experiments and then will be subject to a year-long upgrade from approximately 400 kW to 700 kW of beam power for the NuMI Off-Axis Neutrino Appearance (NOvA) experiment. The NOvA project will enable key measurements of neutrino properties; it is under construction and will be in full operation in 2014. In FY 2011, project engineering and design (PED) funding is provided to initiate the Long Baseline Neutrino Experiment (LBNE) and the Muon to Electron Conversion Experiment (Mu2e) that will use the NuMI beam and other auxiliary beamlines before the end of the next decade. The HEP program is developing the LBNE project in coordination with NSF, which is proposing to construct a Deep Underground Science and Engineering Laboratory (DUSEL) in an old gold mine in South Dakota; DUSEL may be an attractive site for the large LBNE neutrino detector.

The Cosmic Frontier: DOE is partnering with NASA and NSF in world class, space-based and ground-based particle astrophysics observatories for exploration of the Cosmic Frontier. HEP and NASA are presently jointly supporting analysis of data from NASA's Fermi Gamma-ray Space Telescope that detects gamma-rays emanating from astrophysical sources, and HEP continues support for commissioning and integration activities for the Alpha Magnetic Spectrometer experiment which is on NASA's Space Shuttle manifest for launch in 2010. HEP is collaborating with NSF on experiments using ground-based observatories, including the Baryon Oscillation Spectroscopic Survey, which is currently operating, and the Dark Energy Survey, currently in fabrication, and on R&D aimed at developing large, next-generation telescopes that can significantly advance our knowledge of dark energy. HEP and NASA continue to work together to develop a space-based Joint Dark Energy Mission that will complement and extend the ground-based measurements. HEP will also continue to collaborate with NSF on a phased program of research and technology development that is designed to directly detect dark matter particles (rather than indirectly observe their effects on normal matter) using ultra-sensitive detectors located underground.

Significant Program Shifts

Following the recommendations of HEPAP, a continued leadership role for the U.S. HEP program requires investments in new facilities to exploit the scientific opportunities at the research frontiers. In this budget request, there is funding to begin project engineering and design (PED) for the Long Baseline Neutrino Experiment (LBNE) and Muon to Electron Conversion Experiment (Mu2e) to enable future discoveries.

Annual Performance Results and Targets

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering.

GPRA Unit Program Goal: High Energy Physics Program Goal: Explore the Fundamental Interactions of Energy, Matter, Time, and Space—Understand the unification of fundamental particles and forces, and the mysterious forms of unseen energy and matter that dominate the universe; search for possible new dimensions of space; and investigate the nature of time itself.

Annual Performance Measure: Deliver within 20% of baseline estimate a total integrated amount of data (in inverse picobarns [pb^{-1}]) to the CDF and D-Zero detectors at the Tevatron[a].

FY 2006	T: Baseline is 675, so within 20% of baseline is 540 pb^{-1}. A: Goal met
FY 2007	T: Baseline is 800 pb^{-1}, so within 20% of baseline is 640 pb^{-1}. A: Goal met
FY 2008	T: Baseline is 1,000 pb^{-1}, so within 20% of baseline is 800 pb^{-1}. A: Goal met
FY 2009	T: Baseline is 1,684 pb^{-1}, so within 20% of baseline is 1,347 pb^{-1}. A: Met
FY 2010	T: Total is 1,700 pb^{-1}, within 20% is 1360 pb^{-1} A: TBD
FY 2011	T: Total is 1,700 pb^{-1}, within 20% is 1,360 pb^{-1}. A: TBD
FY 2012	T: Completed/Discontinued

Annual Performance Measure: Achieve less than 10% for both the cost-weighted mean percentage variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects.

FY 2006	T: Less than 10% variance from established cost and schedule baselines A: Goal met

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[a] FY 2011 is the last planned year of operations of the CDF and D-Zero detectors.

FY 2007	T: Less than 10% variance from established cost and schedule baselines A: Goal met
FY 2008	T: Less than 10% variance from established cost and schedule baselines A: Goal met
FY 2009	T: Less than 10% variance from established cost and schedule baselines A: Goal met
FY 2010 - 2015	T: Less than 10% variance from established cost and schedule baselines A: TBD

Annual Performance Measure: Achieve greater than 80% average operation time of the scientific user facilities (the Fermilab Tevatron) as a percentage of the total scheduled annual operating time.

FY 2006	T: 80% of scheduled operating time A: Goal not met
FY 2007	T: 80% of scheduled operating time A: Goal met
FY 2008	T: 80% of scheduled operating time A: Goal met
FY 2009	T: 80% of scheduled operating time A: Goal met
FY 2010	T: 80% of scheduled operating time A: TBD
FY 2011	T: 80% of scheduled operating time A: TBD
FY 2012	T: None[a] A: TBD
FY 2013 - 2015	T: 80% of scheduled operating time A: TBD

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[a] The Tevatron complex is shut down in FY 2012 for the installation of the upgrades to the proton accelerator complex for the NOvA project.

Annual Performance Measure: Measure within 20% of the total integrated amount of data (in protons on-target) delivered to the MINOS (or NOvA) detector using the NuMI facility.[a]

FY 2006	T: N/A[b] A:
FY 2007	T: Baseline is 1.5 x 10^{20} protons-on-target to MINOS, so within 20% of baseline is 1.2 x 10^{20} protons-on-target. A: Goal met
FY 2008	T: Baseline is 2.0 x 10^{20} protons-on-target to MINOS, so within 20% of baseline is 1.6 x 10^{20} protons-on-target. A: Goal met
FY 2009	T: Baseline is 2.2 x 10^{20} protons-on-target to MINOS; goal will be met if total integrated amount of data measured is greater than or equal to 1.8 x 10^{20} protons-on-target. A: Goal met
FY 2010	T: 2.7 x10^{20} protons on target to the MINOS. (80% is 2.2 x 10^{20}) A: TBD
FY 2011	T: 2.7 x10^{20} protons on target to the MINOS. (80% is 2.2 x 10^{20}) A: TBD
FY 2012	T: None. A: TBD
FY 2013	T: 1.0 x10^{20} protons on target for NOvA. (80% is 0.8 x 10^{20}) A: TBD
FY 2014	T: 2.5 x10^{20} protons on target for NOvA. (80% is 2.0 x 10^{20}) A: TBD
FY 2015	T: 3.5 x10^{20} protons on target for NOvA. (80% is 2.8 x 10^{20}) A: TBD

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[a] FY 2011 is the last planned year of operations of the MINOS detector, operations of the NOvA detector are planned to start in FY 2013.

[b] NuMI performance measure established in 2007.

Proton Accelerator-Based Physics

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Proton Accelerator-Based Physics			
Research	126,405	125,436	130,299
Facilities	274,963	308,731	308,963
Total, Proton Accelerator-Based Physics	401,368	434,167	439,262

Description

The Proton Accelerator-Based Physics subprogram exploits the application of proton accelerators at two of the scientific frontiers. At the Energy Frontier, experiments at the Tevatron and LHC it will be used to determine whether the Standard Model correctly predicts the mechanism that generates mass for all fundamental particles and will search for the first clear evidence of new physics beyond the Standard Model. At the Intensity Frontier, experiments using the beams from NuMI will make precise, controlled measurements of basic neutrino properties and will provide important clues and constraints on the new world of matter and energy beyond the Standard Model, which is a primary goal of HEP-supported neutrino research.

Selected FY 2009 Accomplishments

- For the first time since the Large Electron-Positron (LEP) collider at CERN last operated in 2000, researchers are again treading on unexplored Higgs territory with the Tevatron Collider experiments at Fermilab. Recently, combined results from the Tevatron Collider experiments have started to exclude a region of Higgs mass between 170 and 181 times the mass of the proton. As more data is collected at the Tevatron, either this exclusion region will expand or the first possible hints of the Higgs boson will appear.

- The Tevatron Collider experiments, CDF and D-Zero, have observed rare Standard Model processes such as double Z boson production, simultaneous W and Z boson production, and single top quark production. The observation of these rare processes is a necessary precursor for the discovery of the Higgs boson. In addition, the Tevatron has also recently produced the most precise measurements of top quark and W boson parameters, which are used to further constrain new physics theories. The innovative analysis methods employed by CDF and D-Zero scientists and the thorough understanding of detector performance and backgrounds displayed in these results also support future discoveries.

- A groundbreaking ceremony was held in May 2009 at the site of the NOvA neutrino detector in northern Minnesota. The NOvA project will fabricate the NuMI Off-Axis Electron Neutrino Appearance (NOvA) detector near the Ash River, about 40 miles southeast of International Falls. This 14,000-ton particle detector is optimized to identify electron-type neutrinos and, using the NuMI beam from Fermilab, will observe for the first time the transformation of muon-type neutrinos into electron-type neutrinos. Fabrication of the NOvA detector was initiated in 2007, and is planned to be complete in FY 2014. Operations are planned to begin with a partially completed detector in 2013.

- Operations of the Large Hadron Collider (LHC) began in late 2009 after a year-long shutdown to repair electrical problems discovered in its initial start-up. The energy of the machine was ramped up to a center-of-mass energy of 2.36 TeV, surpassing the Tevatron Collider as the world's highest energy accelerator, although initial luminosity is very low as the machine is being carefully commissioned. Both the ATLAS and CMS large detectors have observed events and are taking data with fully functional detectors. The LHC is expected to increase its energy and accumulate much more data in 2010 with its first physics run.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Research	**126,405**	**125,436**	**130,299**

The major research activities under the Proton Accelerator-Based Physics subprogram are the research programs using the CDF and D-Zero detectors at the Tevatron at Fermilab, the neutrino research program using the NuMI/MINOS detectors located at Fermilab and at the Soudan Mine site in Minnesota, and the research programs of ATLAS and CMS at the LHC at CERN.

The research program using the Tevatron Collider at Fermilab is being carried out by a collaboration composed of 1,400 scientists from Fermilab, Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), 56 U.S. universities, and institutions in over 20 foreign countries. The major effort in FY 2011 is the collection of data with the CDF and D-Zero detectors. The physics issues to be addressed include searches for the Higgs boson, supersymmetry, or other new phenomena; B meson studies including charge-parity (CP) violation; and precision measurements of the top quark and the W boson properties. In particular, the direct experimental searches for a Standard Model Higgs boson with a mass in the range expected (based on other indirect experimental data) will require the entire Tevatron data set. The Tevatron Collider will continue operations in FY 2011 to provide the two detectors access to the entire region of the expected Higgs mass range.

The research program using the NuMI/MINOS facilities at Fermilab and the Soudan Mine is being carried out by a collaboration that includes 250 scientists from Fermilab, ANL, BNL, 16 U.S. universities, and institutions in five foreign countries. The major effort in FY 2011 will be data collection and analysis, along with optimizing accelerator performance to improve beam intensity for higher statistics measurements. The experiment is planned to complete its data taking in FY 2011 to achieve its ultimate sensitivity, approximately a factor of two improvement over its current result, and will search for the as-yet unseen oscillation of muon neutrinos to electron neutrinos.

In FY 2011, U.S. researchers will play a leadership role in the physics discoveries at the high energies enabled by the LHC. Achieving this goal requires effective integration of U.S. researchers in the LHC detector calibration and data analysis efforts, and implementation and optimization of the U.S. data handling and computing capabilities needed for full participation in the LHC research program. Maintenance of U.S.-supplied detector elements for LHC experiments at CERN will continue.

- **Grants Research**	**59,550**	**59,546**	**61,253**

The grant-based HEP experimental research program consists of groups at more than 60 universities performing experiments at proton accelerator facilities. Grant-supported scientists typically constitute about 50–75% of the personnel needed to create, run, and analyze an experiment, and they

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

usually work in collaboration with other university and laboratory groups. Grant-based research efforts are selected based on peer review, and funded at levels commensurate with the effort needed to carry out the experiments.

In FY 2011, the grant research effort is increased above the FY 2010 level, in order to fully support LHC research activities while maintaining participation in the Tevatron Collider and growing strong neutrino physics programs. Active participation of university physicists is needed to carry out both the collider and neutrino programs at the Tevatron during FY 2011. There will be healthy scientific competition between completion of Run II of the Tevatron Collider program and commencement of the LHC experiments, although the level of this competition will depend on how quickly the LHC will be brought into full operation. Some migration of U.S. university researchers from the LHC back to the Tevatron Collider program has been observed in 2009 due to the delayed startup of the LHC. At the same time, university groups are expected to take important roles in developing the design, physics optimization, and analysis techniques for the planned neutrino initiatives, such as NOvA, Main Injector Experiment v-A (MINERvA), and LBNE. U.S. university groups also have leadership roles in the Tokai-to-Kamioka (T2K) neutrino oscillation experiment that complements and extends the physics reach of NOvA. The detailed funding allocations will take into account the quality and scientific priority of the research proposed.

	FY 2009	FY 2010	FY 2011
▪ **National Laboratory Research**	**65,857**	**64,956**	**68,108**

Proton accelerator research activities concentrate on experiments at the Tevatron complex (collider and neutrino physics programs) at Fermilab and the LHC at CERN. The HEP program conducted a comparative peer review of laboratory research groups in this subprogram in 2009, and findings from this review have been used to inform the funding decisions in the FY 2011 request.

In FY 2011, U.S. laboratory physicists will continue to play important roles in A Large Toroidal LHC ApparatuS (ATLAS) and Compact Muon Solenoid (CMS) experiments, as LHC operations and data analysis move past the commissioning phase into steady-state operations. Strong involvement of physicists from the national laboratories will also be needed to carry out the research program at the Tevatron during FY 2011. The HEP program will monitor progress in these areas and balance resources in order to optimize the national program.

The Fermilab research program includes data collection and analysis of the CDF, D-Zero, and MINOS experiments; the CMS research and computing program; and research related to the NOvA, MINERvA, MicroBooNE, and LBNE experiments. Research at LBNL consists of a large and active group in the ATLAS research program. The BNL research group will focus on the ATLAS research and computing program, with a small effort on D-Zero and an enhanced effort related to future neutrino initiatives, in particular detector design for LBNE. The research group at ANL will be working primarily on the ATLAS research and computing program, analysis of the MINOS data, and research on NOvA. The relatively new research group from SLAC on the ATLAS experiment has taken on important roles in LHC research and data analysis.

	FY 2009	FY 2010	FY 2011
▪ **University Service Accounts**	**998**	**934**	**938**

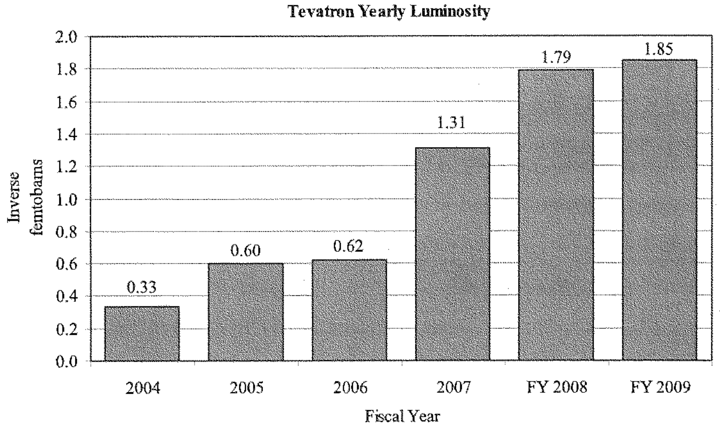
University Service Accounts facilitate the support of university groups working at accelerator facilities. This activity provides funding for these groups to purchase needed equipment and services from the laboratories with a minimum of time and cost overhead. Currently, 45 university groups

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

maintain service accounts at Fermilab and at BNL. Funding for these university service accounts reflects the anticipated need.

Facilities	**274,963**	**308,731**	**308,963**
▪ **Proton Accelerator Complex Operations**	**129,585**	**123,985**	**123,215**

Fermilab operations include running the Tevatron accelerator complex for both collider and neutrino physics programs comprising two collider detectors and several neutrino experiments, respectively. The performance of the Tevatron collider has continued to improve as the laboratory staff has learned to effectively exploit the upgrades that were completed in FY 2006. Tevatron performance improved significantly in FY 2007 and FY 2008 and reached a steady state of high performance in FY 2009. The plot below shows the annual integrated luminosity delivered to the experiments.



Some of the increase in luminosity in FY 2008 was due to additional running time that was scheduled to maximize the integrated luminosity before the first beam collisions at the LHC. Performance in FY 2009 improved and the yearly total was slightly higher than FY 2008 with a normal length run. Performance in FY 2010 and FY 2011 should plateau around two inverse femtobarns per year, so the total delivered luminosity for Run II at the end of FY 2011 should be about twice as large as the total recorded by the end of FY 2009.

In FY 2011, the flat funding in this category reflects the fact that stable running has been achieved and that fewer personnel are needed to run the accelerator. Increased automation of data collection with the CDF and D-Zero detectors has also reduced personnel required for detector operations.

Operations of the Tevatron complex include simultaneous provision of beam for fixed target and collider programs. This dual running mode is necessary for the MINOS and the MINERνA experiments that use neutrinos from the NuMI beamline. The small MINERνA experiment in the MINOS near detector hall at Fermilab is measuring the rates of neutrino interactions with ordinary

(dollars in thousands)

FY 2009	FY 2010	FY 2011

matter. Its results are important for interpreting the data from MINOS and other neutrino experiments, including NOvA.

	FY 2009	FY 2010	FY 2011
Proton Accelerator Complex[a]			
Achieved Operating Hours	5,333	N/A	N/A
Planned Operating Hours	5,040	5,400	5,400
Optimal hours (estimated)	5,400	5,400	5,400
Percent of Optimal Hours	99%	100%	100%
Unscheduled Downtime	16%	N/A	N/A
Total Number of Users	2,160	2,000	1,800

- **Proton Accelerator Complex Support** **18,892** **14,161** **16,617**

  This category includes funding for accelerator improvements, experimental computing expansion, and other detector support, as well as funds for general plant projects (GPP) and other infrastructure improvements at Fermilab. A backlog of GPP projects was addressed with 2009 Recovery Act funding, reducing the need for GPP funds in FY 2010. GPP funding in FY 2011 is increased to the level needed to adequately maintain site infrastructure over the long term.

- **Proton Accelerator Facility Projects** **46,958** **80,173** **74,463**
  - **Current Facility Projects** **32,666** **61,843** **59,220**

    After the completion of Tevatron Collider Run II, it will be possible to adapt portions of the existing collider complex to support operations of the NuMI beam-line at even higher intensity. Reconfiguration of the recycler, which currently serves as a storage ring for antiprotons, can raise the beam power to the NuMI target from 400 kW to 700 kW. Improvements to the cooling, shielding, and power supplies in the booster, main injector, and NuMI beam-line would also be done to support the higher beam intensity.

    Since the increase in neutrino intensity that can be achieved with this reconfiguration will be very important to support the physics goals of the NOvA detector, this collection of upgrades and improvements has been included as part of the scope of the NOvA project in order to ensure appropriate project management oversight and integration.

    The NOvA detector is optimized to identify electron-type neutrinos and, using the NuMI beam from Fermilab, it will observe for the first time the transformation of muon-type neutrinos into electron-type neutrinos. It will also make important indirect measurements from which we may be able to determine the mass hierarchy of the three known neutrino types (e.g., whether there are two light and one heavier type neutrinos or vice versa). This will be a key piece of information that will help determine the currently unknown masses of neutrinos. The project includes the very large far detector (approximately five stories high with a football-field size

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[a] Tevatron and NuMI operations run in parallel.

	FY 2009	FY 2010	FY 2011
(dollars in thousands)			

footprint), the far detector enclosure, its associated electronics and data acquisition system, and a small near detector on the Fermilab site. The project baseline was approved in September 2008, and detector fabrication made significant progress in 2009, using FY 2009 and Recovery Act funds. In FY 2011, TEC funding has decreased from the peak in FY 2010. Fabrication will be completed in FY 2014, but the experiment can start taking data with a partially completed detector in FY 2013.

Funding in FY 2011 includes $8,000,000 to begin fabrication of the MicroBooNE experiment. This is a new Major Item of Equipment (MIE) project that will fabricate a liquid argon neutrino detector to be used in the Booster neutrino beam at Fermilab for the measurement of low energy neutrino cross-sections. These cross sections will be measured at lower neutrino energy than the work planned for MINERvA and will be important for interpreting data from T2K and the proposed Long Baseline Neutrino Experiment (LBNE).

	FY 2009	FY 2010	FY 2011
• **Future Facility Projects R&D**	**14,292**	**18,330**	**15,243**

Pre-conceptual R&D for possible future projects that utilize the Fermilab facility is funded in this category. Specifically, pre-conceptual R&D directed toward detector concepts tied to future facilities, and for a superconducting GeV linac, is supported in FY 2011. This linac would provide the beam power needed to continue high intensity experiments using the Fermilab accelerator complex. It would replace the current linac and booster accelerators at Fermilab, which are over 35 years old, and upgrade the beam power approximately 2–3 times beyond the upgrades planned for NOvA.

	FY 2009	FY 2010	FY 2011
▪ **Large Hadron Collider Support**	**71,897**	**80,161**	**84,033**

U.S. involvement in the LHC has been regularly endorsed by HEPAP and by a National Academies report (EPP 2010[a]). The overall U.S. LHC effort is jointly supported by DOE and NSF and is one of HEP's highest priorities. HEP resources will be used for LHC software and computing, as well as operations and maintenance of the U.S.-built systems that are part of the LHC detectors. The U.S. also participates in accelerator commissioning and accelerator physics studies that use the LHC, along with R&D for potential future upgrades to both the accelerator and its detectors.

	FY 2009	FY 2010	FY 2011
• **LHC Accelerator Research**	**13,000**	**12,390**	**12,409**

The U.S. LHC Accelerator Research Program (LARP) is supported solely by DOE. It will continue to focus its R&D effort on the production of full-scale, accelerator-quality magnets that sustain the highest possible magnetic fields. This R&D effort will provide important technical data to CERN for management decisions on possible future LHC accelerator upgrades to increase luminosity. In late 2009, full-size prototype upgraded high-field LHC interaction region magnets composed of niobium-tin (Nb_3Sn) superconductor material, were demonstrated by the U.S. groups developing this technology. The development of these magnets is in preparation for possible U.S. participation in a second phase of upgrades to LHC. Special instrumentation such as LHC beam collimation and monitoring systems is also being developed under the LARP

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[a] "Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics" is available at http://www.nap.edu/catalog.php?record_id=11641.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

program. These instruments will play an important role in improving and achieving reliable LHC accelerator operations.

	FY 2009	FY 2010	FY 2011
• **LHC Detector Support**	**56,397**	**58,771**	**62,374**

Funding is provided for operations and maintenance of the U.S.-built detector subsystems. These detectors were commissioned with cosmic ray data until the first LHC beam collisions occurred late in 2009. This effort will support the continuing development and deployment of tools and procedures required to collect the detector data at high efficiency and develop the calibration and alignment procedures required in order to understand the detector performance at the level necessary for physics analysis. Support is also provided for technical coordination and program management.

To date, U.S. detector support efforts have focused on hardware commissioning and on the infrastructure needed for full analysis of simulated and cosmic ray data using professional-quality software. Grid computing solutions are integrated into the experiment computing models, building on the tools provided by the Scientific Discovery through Advanced Computing (SciDAC) Open Science Grid project. The grid provides U.S. researchers the access and computing power needed to analyze the large and complex data sets. For FY 2011, computing hardware facilities running grid computing interfaces are essential to enable a rapid development cycle for processing and analyzing the data and improving analysis algorithms as the rate of physics data is expected to increase as accelerator operations become standardized.

Support is also provided for detector R&D, with specific focus on detector technologies needed to accommodate the proposed LHC upgrade in luminosity. Pre-conceptual studies for long-term replacements of major elements of the detectors are ongoing, with proposals expected by the end of 2010. The proposals are expected to cover the two planned phases for LHC upgrades (targeted towards installation in the middle and near the end of the decade, respectively) and will emphasize areas where U.S. groups have particular expertise and technical capability. In FY 2011, funding for LHC upgrade-related detector R&D increases in preparation for possible U.S. participation in these upgrades.

	FY 2009	FY 2010	FY 2011
• **LHC Upgrades**	**2,500**	**9,000**	**9,250**

Fabrication of the Accelerator Project for the Upgrade of the LHC (APUL) will be initiated in FY 2010. The project will construct components needed for the planned increase of the luminosity of the LHC by a factor of two to three. The Mission Need (CD-0) was approved October 2008 and conceptual design has been completed. The scope of the project includes the design and fabrication of magnets, replacing those near ATLAS and CMS whose apertures limit the luminosity, and their associated cold powering and feedboxes. The intent is to have these components built by BNL and Fermilab and delivered to CERN for installation in the LHC by FY 2013. The U.S. scope has been coordinated with CERN management and takes advantage of U.S. expertise in the particular technical areas.

	FY 2009	FY 2010	FY 2011
▪ **Other Facilities**	**7,631**	**10,251**	**10,635**

This category includes funding for long-term D&D of the Alternating Gradient Synchrotron (AGS) facility at BNL, where operations as a HEP user facility were terminated at the end of FY 2002. Funding for private institutions, government laboratories, and foundations that participate in high

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
energy physics research is also included, as well as recurring contributions to general program operations activities, such as the federal laboratory consortium, financial auditing, support for internal and external program and project reviews, personnel support under the Intergovernmental Personnel Act, and technical consultation on programmatic issues. This category also includes funding to respond to new opportunities and unexpected changes in facilities operations and support.			
Total, Proton Accelerator-Based Physics	**401,368**	**434,167**	**439,262**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
▪ **Grants Research**	
Funding for the core grants research program will fully support LHC and Tevatron collider research while growing a strong neutrino physics program to exploit future facilities.	+1,707
▪ **National Laboratory Research**	
Funding will fully support LHC and Tevatron collider research programs and enhance efforts in the neutrino physics program.	+3,152
• **University Service Accounts**	
Funding maintains the support needed for university groups working primarily on research programs at Fermilab and BNL.	+4
Total, Research	**+4,863**
Facilities	
▪ **Proton Accelerator Complex Operations**	
Funding for Proton Accelerator Complex Operations is decreased in FY 2011 due to somewhat reduced personnel needs as Tevatron Collider operations continue. Standardized running procedures and increased automation allow efficient and high performance operation with fewer personnel.	-770
▪ **Proton Accelerator Complex Support**	
Proton Accelerator Complex Support funding increases overall, primarily due to enhancement of GPP funding to the level needed to maintain Fermilab site infrastructure over the long term.	+2,456

	FY 2011 vs. FY 2010 ($000)
▪ **Proton Accelerator Facility Projects**	
• **Current Facility Projects**	
Net funding for Current Facility Projects decreases according to the planned project profiles. Funding decreases for NOvA ($-12,780,000) and MINERvA ($-800,000), offset by increases in funding for MicroBooNE ($+5,957,000) and the other project costs for the new Mu2e project ($+5,000,000).	-2,623
• **Future Facility Projects R&D**	
Funding decreases ($-11,962,000) as the R&D support in FY 2010 for LBNE and Mu2e has shifted out of this category as these efforts become approved projects, offset by increases in funding for pre-conceptual R&D for a superconducting GeV linac, and for specific detector concepts that would make use of possible future Fermilab accelerator facilties ($+8,875,000).	-3,087
Total, Proton Accelerator Facility Projects	**-5,710**
▪ **Large Hadron Collider Support**	
LHC Support increases for pre-conceptual R&D on technologies relevant to the proposed LHC Detector upgrades. ATLAS and CMS operations and support are maintained at about FY 2010 effort levels. LARP and LHC upgrade project (APUL) are continued at FY 2010 levels.	+3,872
▪ **Other Facilities**	
Funding provides for continued service and support in FY 2011 at approximately the same level of effort as FY 2010.	+384
Total, Facilities	**+232**
Total Funding Change, Proton Accelerator-Based Physics	**+5,095**

Electron Accelerator-Based Physics

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Electron Accelerator-Based Physics			
Research	16,699	15,353	14,927
Facilities	15,331	12,074	9,780
Total, Electron Accelerator-Based Physics	32,030	27,427	24,707

Description

The Electron Accelerator-Based Physics subprogram utilizes accelerators with high-intensity and ultra-precise beams to create and investigate matter at its most basic level. Over the last decade, the electron B-factory at SLAC led investigations at the Intensity Frontier, providing precision measurements of different behavior of matter and antimatter observed in the decay products of B-mesons. Physicists consider this asymmetric behavior, called charge-parity (CP) violation, to be vital to understanding the apparent predominance of matter over antimatter, one of the greatest puzzles in comprehending the structure of the universe. There are currently proposals in Italy and Japan for next-generation Intensity Frontier electron-positron colliders, so-called "Super-B Factories" because they are successors to the B-factory at SLAC, whose goal is to fully understand CP violation in B-mesons and hopefully find evidence for unexpected new phenomena.

Selected FY 2009 Accomplishment

Over the past several years, the B-factories in the U.S. and Japan have discovered several unexpected new particles which contain a charm quark and a charm antiquark. However, the masses and decay patterns of these new states do not fit within the theoretical expectations from Quantum ChromoDynamics (QCD) for standard strongly bound quark-antiquark states, and the evidence for some of these new states is controversial and in need of independent confirmation. These recently discovered exotic particles may be hybrid quark-antiquark-gluon states, loosely bound "molecules" of conventional charmed mesons, or four quark states. The exploration of this unforeseen new spectroscopy is an essential step towards fully understanding QCD. Studies of these exotic hadrons with the full B-factory datasets are ongoing.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	**16,699**	**15,353**	**14,927**

The research program at the B-factory/BaBar Facility at SLAC will continue analysis of the 557 fb^{-1} data set that has been accumulated over the nine-year operational life of the facility. The number of physicists involved in this effort is expected to fall to approximately 300 over the course of the year as analysis is completed on portions of the data. Physicists from approximately 30 universities, three national laboratories (LLNL, LBNL, and SLAC), and seven foreign countries have been actively involved in the data analysis. The physics issues to be addressed include expanding our understanding

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

of CP violation in many particle decay modes and the investigation of the many heavy quark states predicted by QCD.

The research program at other electron accelerator facilities complements the B-factory/BaBar efforts and consists of a group of experimental research activities using the Cornell Electron Storage Ring (CESR) accelerator at Cornell University, the KEK-B electron accelerator facilities in Japan, and recently upgraded electron accelerator facilities in China. A total of four U.S. university groups work at KEK-B, four groups work at the Beijing Electron-Positron Collider (BEPC), and 22 U.S. university groups work at CESR. CESR, operated by NSF, also completed running in FY 2008. There are also small R&D efforts aimed at designing detectors for a possible next-generation "Super-B factory" in Italy or Japan.

	FY 2009	FY 2010	FY 2011
▪ **Grants Research**	**6,872**	**6,511**	**6,337**

Grant-supported scientists typically constitute about 50–75% of the personnel needed to create, run, and analyze an experiment, and they usually work in collaboration with other university and laboratory groups. Grant-based research efforts are funded based on peer review and at levels commensurate with the effort needed to carry out the experiments.

In FY 2011, funding continues at a reduced level of effort to complete analysis of physics data from BaBar and the CLEO-c experiment at CESR. Smaller efforts devoted to operations of the Belle detector at KEK B, and the Beijing Spectrometer at BEPC and the analysis of data taken there are supported. Also supported is a small research program devoted to physics studies of a much higher performance, higher intensity B-factory. The Italian government is supporting pre-conceptual R&D aimed at developing a proposal for such a facility. The detailed funding allocations will take into account the quality and scientific priority of the research proposed.

	FY 2009	FY 2010	FY 2011
▪ **National Laboratory Research**	**9,817**	**8,816**	**8,565**

The national laboratory research program consists of groups at four laboratories participating in experiments at electron accelerator facilities with a physics program similar to the grant program described above. Electron accelerator research activities concentrate on experiments at the SLAC B-factory. HEP will conduct a comparative peer review of laboratory research groups in this subprogram in FY 2010.

In FY 2011, laboratory-based research in this subprogram continues at about the same level of effort to complete data analysis from BaBar and CLEO-c. SLAC will continue to maintain strong participation in the B-factory research program, which will be completing a period of intense analysis of the entire B-factory data set and will be focused on final archival analyses. Research groups at LBNL and LLNL have mostly transitioned to other activities. A small research program at Fermilab and SLAC devoted to physics studies of the International Linear Collider is also supported.

	FY 2009	FY 2010	FY 2011
▪ **University Service Accounts**	**10**	**26**	**25**

University Service Accounts facilitate the support of university groups working at accelerator facilities by providing funds for these groups to purchase needed supplies and services from the laboratories with minimum time and cost overhead. Currently 12 university groups maintain service accounts at SLAC.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Facilities	**15,331**	**12,074**	**9,780**
- **Electron Accelerator Complex Operations**	**10,951**	**11,194**	**8,880**

B-factory operations ended in FY 2008. Funding in this category supports the transition of the B-factory accelerator complex to a safe and stable maintenance mode and decommissioning and decontamination (D&D) activities. The funding category also supports ongoing BaBar computing operations and data analysis.

	FY 2009	FY 2010	FY 2011
- **Electron Accelerator Complex Support**	**4,380**	**880**	**900**

Funding is provided for the necessary maintenance and operation of computing capabilities in order to support the timely analysis of the B-factory data.

	FY 2009	FY 2010	FY 2011
Total, Electron Accelerator-Based Physics	**32,030**	**27,427**	**24,707**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
Funding for electron accelerator-based experimental research is reduced to a level necessary to complete analysis of physics data from BaBar and CLEO-c. Analysis of the final archival results from BaBar and CLEO-c data is planned to be completed in 2011.	-426
Facilities	
- **Electron Accelerator Complex Operations**	
Funding for B-factory Operations is reduced to support the planned profile for safe dismantling and decommissioning of the BaBar detector and putting the accelerator into a minimum maintenance configuration.	-2,314
- **Electron Accelerator Complex Support**	
Funding is increased slightly to maintain the computing capabilities needed to finish BaBar data analysis.	+20
Total, Facilities	**-2,294**
Total Funding Change, Electron Accelerator-Based Physics	**-2,720**

Non-Accelerator Physics
Funding Schedule by Activity

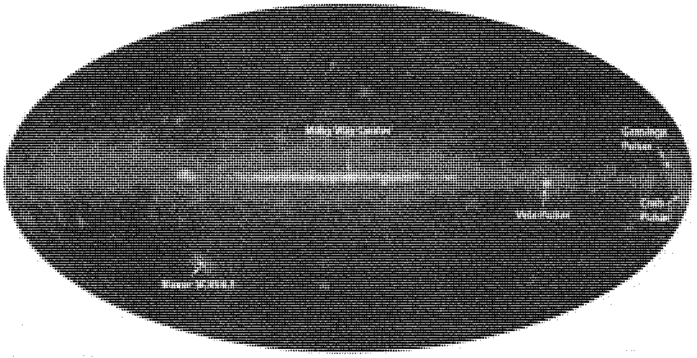
	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Non-Accelerator Physics			
Grants Research	22,215	21,753	22,556
National Laboratory Research	40,181	40,813	43,923
Projects	35,542	37,059	22,060
Other	3,200	0	0
Total, Non-Accelerator Physics	101,138	99,625	88,539

Description

The Non-Accelerator Physics subprogram provides U.S. leadership in the study of those topics in particle physics that cannot be investigated with accelerators or are best studied by other means. For example, some of the earliest discoveries in particle physics were due to the production of previously unobserved particles in high-energy cosmic rays. Non-Accelerator Physics studies play an important role in the HEP program, using ever more sophisticated techniques to probe fundamental physics questions with naturally occurring particles and phenomena. Scientists in this subprogram investigate topics central to both the Intensity and Cosmic Frontiers, such as understanding the nature of dark matter and dark energy; precision measurements of neutrino properties that will illuminate their role in the history of the universe; and searches for new phenomena such as proton decay and primordial antimatter. These areas of research probe well beyond the Standard Model of particle physics and offer possibilities for discovery of significant new physics.

Selected FY 2009 Accomplishments

- In FY 2009, the Large Area Telescope (LAT), the primary instrument on NASA's Fermi Gamma-ray Space Telescope (FGST) mission, performed outstandingly delivering data that has resulted in over 35 peer reviewed publications and motivated a week-long workshop to present and discuss what these results mean for astronomy, astrophysics, and particle physics. The initial results from FGST were selected by the editors of *Science* magazine as the runner-up "Breakthrough of the Year" for 2009, noting, "The Fermi Telescope has ... revealed, with unprecedented detail, a very restless high-energy universe, and it is solving old mysteries while making new, unexpected discoveries." The international LAT collaboration released an all-sky survey which shows the universe as seen in high-energy gamma rays (see the figure below). The LAT was a joint DOE and NASA project. SLAC led the DOE participation in the fabrication of the LAT and operates the instrument science operations center while data are taken.



Fermi Gamma-ray Space Telescope image of the night sky as seen in high-energy gamma rays

- The Cryogenic Dark Matter Search (CDMS) experiment announced in late 2009 the final results of the first phase of their experiment, based on several years of data taking with a few kilograms of ultra-sensitive silicon and germanium detectors that can detect extremely rare dark matter interactions. They found two events in their signal region, but this could be a statistical fluctuation of the expected background due to naturally-occuring radioactivity. An upgraded 15 kg detector with improved background rejection is in fabrication (SuperCDMS) and will be installed and operated in 2010 to confirm or deny the tantalizing initial results. Other experiments using different techniques are also actively exploring this region.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Grants Research	**22,215**	**21,753**	**22,556**

The grant-based program supports research groups at more than 35 universities that perform experiments at non-accelerator-based physics facilities. This program also funds private institutions, government laboratories, and foundations that participate in non-accelerator-based physics research. This subprogram is carried out in collaboration with physicists supported by other government agencies and institutes; among them NSF, NASA, and the Smithsonian Astrophysical Observatory. The selection of research efforts supported is based on peer review. The amount of funding a grant receives takes into account the discovery potential of the proposed research.

In FY 2011, the Non-Accelerator Physics grants program will support research on experiments that are now engaged in data collection, as well as preparations for future experiments. The operating experiments include the Very Energetic Radiation Imaging Telescope Array System, a ground-based gamma ray experiment at the Whipple Observatory in Arizona; the Pierre Auger Observatory in Argentina; and the LAT gamma-ray survey on NASA's FGST space-based mission. Other active research efforts include searches for dark matter using the upgraded "Super" Cryogenic Dark Matter Search (SuperCDMS) at the Soudan Mine in Minnesota and the Axion Dark Matter eXperiment (ADMX) at LLNL, as well as other dark matter searches using different techniques. Studies of dark

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

energy use data from the Baryon Oscillation Spectroscopic Survey (BOSS) experiment on the Sloan Digital Sky Survey telescope in New Mexico. Research also continues with Super-Kamiokande, a proton decay and neutrino detector located in the Kamioka Underground Laboratory in Japan and the Enriched Xenon Observatory (EXO), which is searching for neutrino-less double beta decay at the DOE Waste Isolation Pilot Plant facility in New Mexico.

These groups also participate in the research and planning for the Reactor Neutrino Detector at Daya Bay in China, the Dark Energy Survey (DES) experiment in Chile, the proposed space-based Joint Dark Energy Mission (JDEM), and the proposed ground-based Large Synoptic Survey Telescope (LSST); the latter two will both be used to study dark energy. DOE-supported university groups also lead the commissioning and integration for NASA's Alpha Magnetic Spectrometer (AMS) experiment which is on the Space Shuttle manifest for launch in 2010 and will begin taking data in FY 2011.

HEP also supports research groups participating in the design and R&D efforts for next-generation dark matter experiments and a next-generation neutrino-less double beta decay experiment.

National Laboratory Research	**40,181**	**40,813**	**43,923**

Groups at several national laboratories (ANL, BNL, Fermilab, LBNL, LLNL, LANL, and SLAC) currently participate in non-accelerator-based physics experiments. With strong laboratory technical resources, the laboratory groups provide invaluable and unique service to the research program in terms of experiment management, design, construction, and operations. Laboratory scientists are also involved in the research. The HEP program will conduct a comparative peer-review of the laboratory research efforts in this subprogram in 2010.

In FY 2011, the laboratory research program in non-accelerator physics will continue to support research and operations for ongoing experiments such as the Pierre Auger Observatory, SuperCDMS, the Chicagoland Observatory for Underground Particle Physics 60 kg (COUPP-60) experiment, ADMX, BOSS, EXO, and the LAT gamma-ray survey on NASA's FGST. SLAC runs the instrument science operations center for the LAT. Laboratory groups also lead the operations and research for various dark energy surveys that use existing telescope facilities.

Laboratory groups participate in the research planning for future experiments completing their fabrication phase such as DES. The laboratory groups also focus on the R&D and design efforts for other future projects such as the COUPP-500kg, other next generation dark matter experiments, and the proposed JDEM and LSST experiments to study dark energy.

Projects	**35,542**	**37,059**	**22,060**
▪ **Current Projects**	**24,700**	**21,110**	**6,060**

Funding for the fabrication of the Reactor Neutrino Detector MIE continues in FY 2011. DOE and the Chinese Institute for High Energy Physics are partners for this experiment, which will be located at a site near several commercial nuclear reactors in Daya Bay, China. This experiment will measure and compare the number of neutrinos observed by a detector close to a reactor (the near detector) with the number observed in a far detector about 10 km away. From this data, a crucial neutrino oscillation parameter can be extracted. The U.S. collaboration is led by groups from BNL and LBNL. The project is expected to be completed in FY 2013.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

Final funding for the DES MIE is provided in FY 2011, with final project completion to occur one year later. DOE is supporting the fabrication of a new camera to be installed and operated on the existing Blanco four-meter telescope at the Cerro Tololo Inter-American Observatory (CTIO) in Chile. The DES project is a partnership between DOE, NSF, which operates the telescope, and international participants. The data management system and upgrades to the telescope facility are supported by NSF.

	FY 2009	FY 2010	FY 2011
▪ **Future Projects R&D**	**10,842**	**15,949**	**16,000**

This category provides support for R&D and pre-conceptual design activities for promising proposed future experiments. In FY 2011, this includes R&D on technical issues related to DOE's proposed contribution for the JDEM and LSST projects. DOE, NASA, and NSF await input from the community on the scientific priority given to these projects in the National Academies' Decadal Survey for Astronomy and Astrophysics. This report is due in summer 2010.

	FY 2009	FY 2010	FY 2011
Other	**3,200**	**0**	**0**

FY 2009 funding provided for completion of EXO-200 experiment at the Waste Isolation Pilot Plant.

	FY 2009	FY 2010	FY 2011
Total, Non-Accelerator Physics	**101,138**	**99,625**	**88,539**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Grants Research	
Funding for grant-based research continues at a constant level of effort in order to support experiments that are currently active in commissioning, operations, and/or data analysis and to respond to new research proposals.	+803
National Laboratory Research	
Funding for laboratory-based research is enhanced to provide support for pre-operations, operations, and commissioning for projects that have reached or will soon reach completion (SuperCDMS, DES).	+3,110
Projects	
▪ **Current Projects**	
Following the planned project profiles, funding decreases for Reactor Neutrino Detector ($-8,940,000), DES ($-4,610,000), and SuperCDMS ($-1,500,000).	-15,050

	FY 2011 vs. FY 2010 ($000)
- **Future Projects R&D** R&D funding is provided for proposed ground-based and satellite-based dark energy, dark matter, and other particle astrophysics experiments. This funding is maintained at approximately the FY 2010 level. Allocated funding will utilize guidance from the community on the priority given to these projects in the National Academies' Decadal Survey.	+51
Total, Projects	**-14,999**
Total Funding Change, Non-Accelerator Physics	**-11,086**

Theoretical Physics
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Theoretical Physics			
Grants Research	26,801	26,801	27,555
National Laboratory Research	24,549	25,105	26,290
Computational HEP	11,280	10,000	10,400
Other	3,518	5,056	5,279
Total, Theoretical Physics	66,148	66,962	69,524

Description

The Theoretical Physics subprogram provides the vision and mathematical framework for understanding and extending the knowledge of particles, forces, space-time, and the universe. This program supports activities that range from detailed calculations of the predictions of the Standard Model to the extrapolation of current knowledge to a new level of understanding and the identification of the means to experimentally search for them. Symmetries play a major role in the current understanding of the subatomic world: discovering how particle symmetries are realized (or broken) in nature has provided many fundamental breakthroughs in the development of the Standard Model. This subprogram supports and advances research at all three high energy physics Frontiers.

Selected FY 2009 Accomplishments

- The 2008 Nobel Prize in Physics, announced in October 2008, was shared by Yoichiro Nambu for his theoretical work discovering how symmetry breaking can manifest itself in nature. His work was supported by HEP.
- High precision numerical simulations of the strong interactions of quarks and gluons, Quantum Chromodynamics (QCD), are producing accurate and reliable predictions of strong interaction decay constants and mass differences. These results, which use supercomputer simulations of QCD, include the important but difficult to calculate "virtual quark" effects in the underlying field theory. In some important cases, the agreement between the theoretical and experimental values has reached the level of the experimental uncertainty itself. This is a major success of the theory of strong interactions and is an improvement by nearly an order of magnitude over previous calculations. These breakthroughs have been accomplished by the application of new, highly efficient algorithms combined with the use of today's supercomputers and dedicated clusters of personal computers. The support for these research breakthroughs has come from ongoing efforts in the core HEP theory research program, as well as the SciDAC program for high-performance software, and investments in dedicated computing hardware to enable fast and reliable calculations.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Grants Research	**26,801**	**26,801**	**27,555**

This program consists of research groups at approximately 70 colleges and universities. It includes funding for private institutions, universities, and foundations that participate in theoretical physics. As part of their research efforts, the university groups train graduate students and postdoctoral researchers. Physicists in this theoretical research area often work in collaboration with other university and laboratory groups. Research efforts are selected based on a peer review process.

The grants program addresses topics across the full range of theoretical physics research. A particularly interesting topic considers additional space-time dimensions that are normally hidden. This is motivated by the effort to unify Einstein's theory of gravity with quantum mechanics in a consistent way. Some of these extra dimensions and their consequences may be accessible to experimental investigation and may manifest themselves at the LHC as so-called Kaluza-Klein excitations, named after the physicists who first suggested in the 1920s that we live in a 5-dimensional universe. Another topic of current research interest is the nature of dark matter and dark energy in the context of high energy physics. University research groups play leading roles in addressing these research areas.

In FY 2011, the Theoretical Physics Grants program supports enhanced efforts focused on the analysis of current and previous experiments and in the design and optimization of new experiments, so that these experiments can fulfill their maximum potential. It will also support theorists who explore new ideas of physics at all three particle physics Frontiers.

National Laboratory Research	**24,549**	**25,105**	**26,290**

The national laboratory theoretical research program currently consists of groups at seven DOE laboratories (Fermilab, SLAC, BNL, ANL, LBNL, LLNL, and LANL). The laboratory theory groups are a resource for the national research program, with a particular emphasis on collaborations with experimental scientists and data interpretation to provide a clear understanding of the significance of measurements from ongoing experiments and to help shape and develop the laboratories' experimental programs. HEP conducted a comparative peer-review of the laboratory research efforts in this subfield in 2008 whose findings have been used to inform the funding decisions in this budget request; in particular there are targeted increases to support laboratory research programs which reviewed well. HEP will review these programs again in 2011.

In FY 2011, the laboratory theoretical research groups will address topics across the full range of theoretical physics, including the analysis and interpretation of the new data expected from the Tevatron Collider detectors and forthcoming data from the LHC. There are also efforts to understand properties of neutrinos through reactor, accelerator, and non-accelerator neutrino experiments. As data from the LHC becomes available, an increased effort will be made to identify the most promising and sensitive methods for finding signs of new phenomena in these data.

Computational HEP	**11,280**	**10,000**	**10,400**

This budget category provides for specific high energy physics research activities that require extensive or customized computational resources including R&D, design, fabrication, procurement, maintenance, and operation of computational software and hardware that is not associated with specific high energy physics experiments or research facilities. Current activities in this category include the Scientific

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

Discovery through Advanced Computing (SciDAC) program, the Lattice QCD (LQCD) computing initiative, support for dedicated transatlantic networking, and U.S. contributions to experiment-independent computer codes required for HEP's program.

	FY 2009	FY 2010	FY 2011
▪ **SciDAC**	**6,100**	**6,000**	**5,600**

All HEP-supported SciDAC projects had mid-term continuation reviews in FY 2009 and are planned to be re-competed in FY 2011. The SciDAC program is managed and cooperatively funded by the SC program offices, including the Advanced Scientific Computing Research program. There are four principal HEP-supported SciDAC efforts: Type Ia supernova simulations, to better understand the thermonuclear explosions that create supernovae and to generate supernova light curves appropriate for dark energy measurements, a joint effort with Nuclear Physics (NP) and the National Nuclear Security Administration; platform-independent software to facilitate large-scale QCD calculations (see also the LQCD computing initiative below), a joint effort with NP; very large scale, fault-tolerant data handling and distributed grid computing which will allow physicists in the U.S. to analyze petabytes of data produced in Europe at the LHC, a joint effort with NP and NSF; and large-scale computational infrastructure for accelerator modeling and optimization, to support design and operations of complex accelerator systems throughout the SC complex, a joint effort with NP and the Basic Energy Sciences program.

	FY 2009	FY 2010	FY 2011
▪ **Computational QCD and Network Support**	**5,180**	**4,000**	**4,800**

The understanding of many HEP experimental results has been limited by a lack of precision in QCD calculations which describe the underlying physics; these calculations are in turn limited by a lack of computational power. This activity includes funding for the LQCD computing initiative that is a coordinated effort with the NP program aimed toward the development, procurement, and operation of a multi-teraflop computer capability for dedicated LQCD simulations. During FY 2009, the first phase of this joint effort was completed and provides on average about 13 teraflops of capacity. This investment is coordinated with the SciDAC QCD effort described above to ensure that the software codes developed can be run on a variety of available hardware platforms and used by a wide community of researchers. There is a follow-on proposal to deploy approximately 100 teraflops of dedicated capacity for QCD computing, which is currently under review.

This category also includes funding for the HEP-related transatlantic network requirements between the U.S., CERN, and HEP-related computing facilities in Europe. These requirements are dictated by the unprecedented size of the LHC data set. The dedicated network paths are known as the U.S. LHC Net. In FY 2009, the U.S. LHC Net provided 40 gigabits per second of connectivity between CERN and points of presence in Chicago and New York and is being upgraded to 60 gigabits per second. U.S. LHC Net is closely integrated with the DOE Energy Science Network, which connects the U.S. LHC Net transatlantic bridge to the main U.S. research network backbone.

	FY 2009	FY 2010	FY 2011
Other	**3,518**	**5,056**	**5,279**

This activity includes funding for education and outreach activities, compilations of high energy physics data, reviews of data by the Particle Data Group at LBNL, conferences, studies, workshops, funding for theoretical physics research activities to be determined by peer review, and for responding to new and unexpected physics opportunities. This category also includes funding for the QuarkNet education project. This project takes place in QuarkNet centers which are set up at universities and laboratories

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
around the country. The purpose of each center is to engage high school physics teachers in the analysis of real data from an active high energy physics experiment (such as at the Tevatron Collider or LHC). The experience these teachers garner is taken back to their classrooms in order to expose high school students to the world of high energy physics. The project began in 1999.			
Total, Theoretical Physics	**66,148**	**66,962**	**69,524**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Grants Research	
The Theoretical Physics Grants program is supported at a constant level of effort that will support the analysis of current and previous experiments, and in the design and optimization of new experiments.	+754
National Laboratory Research	
The National Laboratory Research program is increased above a constant level of effort to provide additional support for the laboratory research groups which performed well in the HEP comparative review in 2008.	+1,185
Computational HEP	
The final allocation of funding among the activities in this category (SciDAC, LQCD, and Network Support) will depend upon peer-review of proposed activities, identified scientific priorities, and program needs and will provide for a constant level of support compared to FY 2010 funding levels.	+400
Other	
The increase maintains approximately a constant effort in education and outreach activities, and the data compilations and summaries provided by the Particle Data Group at LBNL.	+223
Total Funding Change, Theoretical Physics	**+2,562**

Advanced Technology R&D
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Advanced Technology R&D			
Accelerator Science	51,999	47,324	52,135
Accelerator Development	98,520	90,501	91,611
Other Technology R&D	24,665	24,819	26,195
SBIR/STTR	0	19,658	20,027
Total, Advanced Technology R&D	175,184	182,302	189,968

Description

The Advanced Technology R&D subprogram fosters world-leading research in the physics of particle beams, accelerator research and development, and particle detection—all necessary for continued progress in high energy physics. High energy physics research relies on the use of high energy and high intensity particle beams generated with charged particle accelerators, storage rings, and their associated tracking and identification detectors. New developments are stimulated and supported through proposal driven, peer reviewed research. Ultimately, these new technological developments are incorporated into construction projects sponsored by HEP. This subprogram supports and advances research at all three high energy physics Frontiers. Advanced Technology R&D also provides new technologies and research methods appropriate for a broad range of scientific disciplines, thereby enhancing DOE's broader strategic goals for science.

Selected FY 2009 Accomplishments

- A collaboration of laboratories, universities, and small businesses has significantly advanced the state of the art for accelerating gradients in normal-conducting accelerating cavities, which is approximately 50 MeV per meter. This effort is directed towards reducing the size and cost of future TeV-scale lepton colliders. At ANL, an intense pulse of electrons was used to excite a microwave field of 100 MeV per meter in a dielectric-loaded accelerating structure. An MIT-designed photonic band-gap accelerating structure also achieved 100 MeV per meter. SLAC has demonstrated 150 MeV per meter in a single-cell, standing-wave copper structure.
- An example of a novel detector technology that was recently developed with DOE support is a large-area single photon sensor with extremely low radioactivity. These new photodetectors will enable cost-effective scale-up of highly sensitive photon detectors (such as dark matter detectors) that require large active volumes along with extremely low backgrounds from naturally-occurring radioactivity. This technology has a patent application pending and is being commercialized.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Accelerator Science	**51,999**	**47,324**	**52,135**

This activity focuses on understanding the science underlying the technologies used in particle accelerators and storage rings, as well as the fundamental physics of charged particle beams. Funding in this category includes costs for operating university and laboratory-based accelerator R&D test facilities.

	FY 2009	FY 2010	FY 2011
▪ **Grants Research**	**9,060**	**9,060**	**9,725**

The FY 2011 budget will continue support for a broad research program in advanced accelerator physics and related technologies. Funding is increased above a constant level of effort to support increased university participation in experiments at new accelerator R&D facilities (BELLA and FACET, see below). Funding is included for private institutions, universities, industry, and federal research centers that participate in fundamental accelerator physics. As part of their research efforts, these groups train graduate students and postdoctoral researchers. Physicists in this research area often work in collaboration with other university and laboratory groups. For example, university groups are leading the development and execution of the proposals for the experimental program at FACET. Research efforts are selected based on a peer review process.

The grant-based research program will continue to investigate novel acceleration concepts, such as the use of plasmas and lasers to accelerate charged particles; theoretical studies in advanced beam dynamics, including the study of non-linear optics and space-charge dominated beams; studies of accelerating gradient limits in normal conducting accelerators; development of advanced particle beam sources and instrumentation; and accelerator R&D into the fundamental issues associated with the ionization cooling of muon beams.

	FY 2009	FY 2010	FY 2011
▪ **National Laboratory Research**	**34,939**	**38,264**	**42,410**

This activity supports accelerator R&D efforts and operations of test facilities at ANL, BNL, Fermilab, LBNL and SLAC, and theoretical studies of space-charge dominated beams at the Princeton Plasma Physics Laboratory. HEP conducted a comparative peer-review of the laboratory research efforts in this subfield in 2008, whose findings have been used to inform the funding decisions in this budget request; in particular there are targeted increases to support laboratory research programs which reviewed well. HEP will review these programs again in 2011.

The national laboratory accelerator science program explores advanced methods to accelerate charged particles with the goal of more efficient, compact, and inexpensive particle accelerators. Efforts in FY 2011 will focus on the development of new accelerating structures and techniques needed to achieve accelerating gradients in excess of 100 MeV/m. This work currently occurs primarily at the Argonne Wakefield Accelerator, the Laser Optical Accelerator Systems Integrated Studies (LOASIS) test facility at LBNL, and the new Facility for Accelerator Science and Experimental Test Beams (FACET) at SLAC. The new BErkeley Lab Laser Accelerator project (BELLA, see Projects below) will be in full fabrication in FY 2011 with completion planned for FY 2012. In FY 2011, the first round of experiments will begin at the new FACET facility where an electron bunch (the beam is not a continuous stream of electrons but structured in discrete bunches) is accelerated by plasma wakefields. The goal of this effort will be a demonstration of efficient, full-length accelerating structures with gradients well above 1 GeV per meter. Funding for FACET operations is included in this category.

The national laboratory groups are also involved in a significant long-range R&D effort to demonstrate the advanced technologies needed to realize muon-based accelerators; this is a global R&D program with major U.S. participation at Fermilab and BNL. A five-year R&D plan for muon-based accelerators, with milestones and deliverables, has been submitted by U.S. research institutions and will be reviewed by HEP in 2010.

BNL is also the home of the very successful Accelerator Test Facility. The facility supports HEP-funded research at universities as well as through the Small Business Innovation Research (SBIR) program, based on proposal-driven, peer-reviewed research in accelerator concepts and beam physics. In FY 2011, the facility will continue a program to test advanced accelerator concepts, develop new instrumentation, and further next-generation, high-brightness electron sources that are based on laser-driven photocathodes.

▪ **Projects**	**8,000**	**0**	**0**

Funding was provided in the FY 2009 Appropriation and in the FY 2009 Recovery Act for the BELLA Project. BELLA will further advance the world-leading laser-driven plasma acceleration program, with a focus on exploring concepts for cascading GeV wakefield accelerating modules, a promising path to higher gradients and energies. LOASIS has already accelerated high-quality electron beams to energy exceeding 1 GeV in a 3 centimeter long structure. BELLA will initially improve this by a factor of ten, to 10 GeV in a one meter long structure. BELLA is planned to be complete in FY 2012.

Accelerator Development	**98,520**	**90,501**	**91,611**

The task of this activity is to demonstrate the feasibility of concepts and technical approaches on an engineering scale. This includes R&D and prototyping to bring new concepts to a stage of engineering readiness where they can be incorporated into existing facilities, upgrade existing facilities, or applied to the design of new facilities. Carrying out development of advanced high-technology components at this level often requires significant investments in research infrastructure. Major thrusts in this activity are superconducting radio frequency (RF) infrastructure development, studies of very high intensity proton sources for potential application in neutrino physics research, and R&D relevant to the proposed International Linear Collider.

▪ **General Accelerator Development**	**39,520**	**33,501**	**34,171**

This activity focuses on R&D that can be widely applied to a range of accelerator facilities. The work is primarily done at Fermilab, LBNL, SLAC, and BNL. The major areas of R&D are superconducting magnet and related materials technology; high-powered RF acceleration systems; instrumentation; beam dynamics, both linear and nonlinear; and development of large simulation programs. The latter effort is coordinated with the SciDAC accelerator simulation project.

The R&D program on high-power RF systems is led by SLAC, including simulation codes for modeling RF system components and high-powered microwave tubes. This program also builds custom high-power RF sources for HEP and other scientific applications.

(dollars in thousands)

Fermilab leads the R&D for a future high-intensity neutrino beam facility, in particular developing very high intensity proton sources for neutrino physics research.

The R&D program on superconducting magnets and materials includes efforts at BNL, Fermilab, and LBNL, focusing on demonstrating very high field superconducting magnets using advanced superconducting materials, and an industrially-based program to develop these materials, particularly niobium-tin.

	FY 2009	FY 2010	FY 2011
- **Superconducting RF R&D**	**24,000**	**22,000**	**22,440**

Superconducting Radio Frequency (SRF) technology is applicable to a variety of future accelerator projects central to the HEP scientific strategy. Centered at Fermilab, the program supports development of the infrastructure necessary for SRF development and includes equipment and facilities for accelerator cavity processing, assembly, and testing and for cryomodule assembly and testing. The infrastructure will be utilized to improve cavity and cryomodule performance and prototype cryomodules for future projects. Information on processing and construction will be of use to a broad spectrum of projects throughout the Office of Science. Completion of this essential technology infrastructure was accelerated in FY 2009 using Recovery Act funding.

In FY 2011, this effort will provide funds for procurement of components and equipment support necessary to develop prototype multi-cavity cryomodules. It also enables continued development of U.S. capabilities for testing individual bare cavities, dressed cavities with all power components attached, and cryomodules. Fermilab is the lead U.S. laboratory and coordinates the national R&D program in this area. FY 2011 funding will also be used to support a fundamental research effort in SRF cavity design that aims to enhance the performance capability, gradient, production yield, reliability, lifetime, and cost of the fundamental RF accelerating structures.

Funding in FY 2011 includes $3,200,000 of capital equipment to procure an electron beam welder as an MIE project. The electron beam welder will be located at Fermilab and will be used to assemble and repair niobium superconducting cavities.

	FY 2009	FY 2010	FY 2011
- **International Linear Collider R&D**	**35,000**	**35,000**	**35,000**

A TeV-scale linear electron-positron collider iswidely considered by the international high energy physics community to be a likely successor to the LHC, though the data from the LHC may indicate that an even higher energy accelerator (such as a muon collider) is needed to understand the new physics that emerges at this energy scale. In FY 2007, the International Linear Collider (ILC) collaboration under the auspices of the ILC Steering Group and the direction of the Global Design Effort (GDE) completed a detailed review of the R&D to be accomplished worldwide with milestones and priorities for that work. In FY 2008, the GDE initiated a five-year program to develop a Technical Design Report (TDR) that will address outstanding R&D issues, complete a baseline design, and provide a project implementation plan. Completion of the TDR in 2012 is consistent with worldwide resources currently available for the ILC R&D and coincident with first physics results from the LHC (necessary to finalize operating parameters for a TeV-scale linear collider).

In FY 2011, the ILC R&D program will continue to support an important, leading U.S. role in the comprehensive and coordinated international R&D program. Accordingly, efforts will focus on R&D for systems associated with the generation and maintenance of very bright particle beams, such as electron sources, damping rings, beam dynamics development, and beam delivery systems. Support

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

will also be provided for development and prototyping of high level RF equipment and components associated with the main linac accelerator, including ILC cryomodules. These R&D efforts also have wider applicability to other projects supported by the Office of Science.

Other Technology R&D	**24,665**	**24,819**	**26,195**

This category includes R&D on new particle detector technologies, addressing fundamental scientific problems to foster new technologies in particle detection, measurement, and data processing; and providing support for prototyping and detector systems development to bring the technologies to the maturity where they can be incorporated into future particle physics experiments.

▪ **Detector Development, Grants Research**	**3,492**	**3,568**	**3,688**

The grants-based R&D program provides support for university physicists to develop new detector technologies or advance technologies that have broad applicability to a wide range of high energy physics experiments. This support includes maintaining university infrastructure to enable state-of-the-art R&D into new detector technologies. Technologies targeted for development are selected based on anticipated applications that require further technological improvements before deployment, and specific proposals are selected based on peer-review. Final funding levels depend on the number and quality of proposals received. Current areas of investigation include liquid noble gas detectors, silicon photomultipliers, large area photodetectors, and picosecond timing techniques. This activity was called Advanced Detector Research in past budget submissions.

▪ **Detector Development, National Laboratory Research**	**21,173**	**21,251**	**22,507**

This activity supports detector R&D efforts and operations of test facilities at ANL, BNL, Fermilab, LBNL and SLAC. HEP conducted a comparative peer-review of the laboratory research efforts in this subfield in 2009, whose findings have been used to inform the funding decisions in this budget request.

The FY 2011 request will maintain R&D efforts directed toward developing new detectors, including prototyping and in-beam studies. A diverse program will continue, including efforts on particle flow calorimeters, very low-mass trackers, advanced charged-coupled devices, and radiation resistant, fast readout electronics. Prototype detector systems will be operated in the Fermilab test beam, providing a major test of particle flow algorithms and detector construction techniques. Since the Fermilab test beam is over-subscribed, a reconfiguration of an old experimental beam line at SLAC into a dedicated test beam for detectors to meet this demand is being supported.

This activity was called Detector Development in past budget submissions.

SBIR/STTR	**0**	**19,658**	**20,027**

In FY 2009 $17,730,000 and $2,128,000 was transferred to the congressionally mandated Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, respectively. The FY 2010 and FY 2011 amounts are estimated requirements for the continuation of these programs.

Total, Advanced Technology R&D	**175,184**	**182,302**	**189,968**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Accelerator Science	
▪ **Grants Research**	
Funding for grant-based research increases relative to the FY 2010 level-of-effort to support university participation in experiments at new accelerator R&D facilities.	+665
▪ **National Laboratory Research**	
Funding for the core research program at the laboratories is increased to support enhanced research at newly completed accelerator facilities including FACET.	+4,146
Total, Accelerator Science	**+4,811**
Accelerator Development	
▪ **General Accelerator Development**	
Funding for General Accelerator Development activities maintains about a constant level of effort.	+670
▪ **Superconducting RF R&D**	
Funding for Superconducting RF development supports the planned implementation of capabilities at Fermilab and about a constant level of effort for supporting R&D efforts.	+440
Total, Accelerator Development	**+1,110**
Other Technology R&D	
Funding for Other Technology R&D maintains about a constant level of effort after the funding for the test beam is taken into account.	+1,376
SBIR/STTR	
SBIR/STTR programs are funded at the mandated level.	+369
Total Funding Change, Advanced Technology R&D	**+7,666**

Construction

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Construction			
11-SC-40, Long Baseline Neutrino Experiment, PED	0	0	12,000
11-SC-41, Muon to Electron Conversion Experiment, PED	0	0	5,000
Total, Construction	0	0	17,000

Description

This subprogram provides for the Construction and Project Engineering and Design that is needed to meet overall objectives of the High Energy Physics program.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
11-SC-40, Long Baseline Neutrino Experiment, PED	**0**	**0**	**12,000**

The Long Baseline Neutrino Experiment will be composed of a neutrino beamline, small (near) detector located near to the neutrino beamline, and a large (far) neutrino detector located a long distance from the neutrino source. In order to build a neutrino beam that passes through the earth, a beam of protons must be transported through a tunnel that points into the ground. At the end of the tunnel the protons hit a target producing neutrinos that then travel through the earth. An existing neutrino beam of this type is the Neutrino at the Main Injector (NuMI) beam at Fermilab. The new LBNE beamline would provide low-energy neutrinos, a more intense beam, and point in a different direction from NuMI in order to provide the needed longer distance to the detector to extend the study of neutrino oscillations.

It is expected that the far detector will also need to be located underground to reduce the background from cosmic rays to a manageable level. The scope of work currently being developed includes a neutrino beamline, a small near detector, one or more large far neutrino detectors, the large underground cavern(s) needed to house the far detector(s), and the infrastructure needed to support the construction and operation of the large detector if housed underground.

11-SC-41, Muon to Electron Conversion Experiment, PED	**0**	**0**	**5,000**

The conversion of a muon to an electron in the field of a nucleus provides a unique window on the structure of potential new physics discoveries and allows access to new physics at very high mass scales. The Particle Physics Project Prioritization Panel (P5) identified this opportunity as a top priority for the Intensity Frontier of particle physics.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
This project will construct a new beamline to take protons from the existing 8 GeV Booster synchrotron at Fermilab to a muon production target, a beamline to transport those muons to the detector, a low-mass magnetic spectrometer, which can measure the electron momentum with a resolution of order 0.15%, and a new experimental hall to house the muon production target, muon beamline, and the detector.			
Total, Construction	**0**	**0**	**17,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
11-SC-40, Long Baseline Neutrino Experiment, PED	
Funding is provided to initiate PED activities.	+12,000
11-SC-41, Muon to Electron Conversion Experiment, PED	
Funding is provided to initiate PED activities.	+5,000
Total, Construction	**+17,000**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	679,244	702,203	714,333
Capital Equipment	87,167	103,908	90,131
General Plant Projects	4,417	2,952	7,536
Accelerator Improvement Projects	5,040	1,420	0
Construction	0	0	17,000
Total, High Energy Physics	775,868	810,483	829,000

Funding Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	451,674	448,910	463,970
Scientific User Facilities Operations	247,497	239,711	239,638
Projects			
Major Items of Equipment	69,066	91,953	72,730
Construction	0	0	22,000
Total, Projects	69,066	91,953	94,730
Other	7,631	29,909	30,662
Total, High Energy Physics	775,868	810,483	829,000

Scientific User Facilities Operations

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Tevatron	162,769	156,476	155,075
B-factory	15,331	12,074	9,780
LHC Detector Support and Operations	69,397	71,161	74,783
Total, Scientific User Facilities Operations	247,497	239,711	239,638

Total Facility Hours and Users

	FY 2009	FY 2010	FY 2011
Proton Accelerator Complex[a]			
Achieved Operating Hours	5,333	N/A	N/A
Planned Operating Hours	5,040	5,400	5,400
Optimal hours (estimated)	5,400	5,400	5,400
Percent of Optimal Hours	99%	100%	100%
Unscheduled Downtime	16%	N/A	N/A
Total Number of Users	2,160	2,000	1,800
SLAC B-factory			
Total Number of Users	800	600	300
Total Facilities			
Achieved Operating Hours	5,333	N/A	N/A
Planned Operating hours	5,040	5,400	5,400
Optimal hours (estimated)	5,400	5,400	5,400
Percent of Optimal Hours	99%	100%	100%
Unscheduled Downtime	16%	N/A	N/A
Total Number of Users	2,960	2,600	2,100

Major Items of Equipment (MIE)

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Proton Accelerator-Based Physics							
MINERvA							
Total Estimated Costs (TEC)	5,000	4,900	0	800	0	0	10,700
Other Project Costs (OPC)	6,100	0	0	0	0	0	6,100
Total Project Costs (TPC)	11,100	4,900	0	800	0	0	16,800

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[a] Tevatron and NuMI operations run in parallel.

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
NOvA							
TEC	550	15,542	14,936	59,000	46,220	60,720	196,968
OPC	28,744	12,224	40,064	0	0	0	81,032
TPC	29,294	27,766	55,000	59,000	46,220	60,720	278,000
T2K							
TEC	1,848	1,000	0	0	0	0	2,848
OPC	1,860	0	0	0	0	0	1,860
TPC	3,708	1,000	0	0	0	0	4,708
Accelerator Project for the Upgrade of the LHC							
TEC	0	0	0	TBD[a]	9,250	8,250	17,500
OPC	0	2,500	0	9,000[a]	0	0	11,500
TPC	0	2,500	0	9,000	9,250	8,250	29,000
MicroBooNE[b]							
TEC	0	0	0	0	8,000	8,957	16,957
OPC	0	0	0	2,043	0	0	2,043
TPC	0	0	0	2,043	8,000	8,957	19,000
Non-Accelerator Physics							
Reactor Neutrino Detector							
TEC	5,460	14,000	0	11,000	1,960	500	32,920
OPC	2,480	0	0	0	100	0	2,580
TPC[c]	7,940	14,000	0	11,000	2,060	500	35,500

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[a] This MIE is not yet baselined, and therefore the TEC and OPC have not been determined. Mission Need (CD-0) was approved on November 20, 2008, with an estimated cost range of $25,000,000–$27,000,000. FY 2010 funding is for engineering design only. Engineering design may include limited fabrication and testing of design concepts. Fund for full fabrication will be requested after approval of the Performance Baseline, CD-2.

[b] This MIE is not yet baselined, and therefore the TEC and OPC have not yet been determined. The Mission Need (CD-0) was approved September 2009. The estimated cost range is $17,000,000–$19,000,000.

[c] A baseline change increasing the TPC from $34,000,000 to $35,500,000 with a planned completion date of April 2013 was approved by the Secretarial Acquisition Executive on January 11, 2010. This baseline change was needed to accommodate delays in the civil construction being performed by our Chinese partners.

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Dark Energy Survey							
TEC	1,650	8,990	0	8,610	4,000	0	23,250
OPC	10,990	910	0	0	0	0	11,900
TPC	12,640	9,900	0	8,610	4,000	0	35,150
SuperCDMS at Soudan							
TEC/TPC	0	1,000	0	1,500	0	0	2,500
Advanced Technology R&D							
Advanced Accelerator R&D Test Facility[a]							
BELLA							
TEC	0	8,000	18,718	0	0	0	26,718
OPC	0	0	2,000	0	0	0	2,000
TPC	0	8,000	20,718	0	0	0	28,718
FACET							
TEC	0	0	11,000	0	0	0	11,000
OPC	0	0	2,000	0	0	0	2,000
TPC	0	0	13,000	0	0	0	13,000
Electron Beam Welder							
TEC/TPC	0	0	0	0	3,200	0	3,200

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[a] Two proposals, Berkeley Lab Laser Accelerator (BELLA) Project and the Facility for Accelerator Science and Experimental Test Beams (FACET) were reviewed as candidates for this facility. Both received excellent reviews and using Recovery Act funds, both are proceeding. FACET received only Recovery Act funds and BELLA received both FY 2009 funds and Recovery Act funds. Neither project is baselined yet, so the split between TEC and OPC funds is not yet determined. Mission Need (CD-0) was approved on February 27, 2008 with an estimated cost range of $32,000,000–$37,000,000 for both projects. This early estimate did not explicitly include OPC costs.

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Total MIEs							
TEC		53,432	44,654	80,910	72,630		
OPC		15,634	44,064	11,043	100		
TPC		69,066	88,718	91,953	72,730		

Proton Accelerator-Based Physics MIEs:

Main Injector Experiment ν-A (MINERνA) will make precision measurements of neutrino interaction rates in the NuMI beam, an important input to analyze data from neutrino oscillation experiments (such as MINOS and NOνA). The planned completion for this project is in FY 2010.

NuMI Off-axis Neutrino Appearance (NOνA) Detector will use the NuMI beam from Fermilab to directly observe and measure the transformation of muon neutrinos into electron neutrinos over a distance of 700 km. The project also includes improvements to the proton source to increase the intensity of the NuMI beam. The occurrence of these particular neutrino "flavor" changes is expected to be much rarer than the phenomenon under study with MINOS. The baseline was approved in September 2008 with a TPC of $278,000,000. A total of $55,000,000 was provided under the Recovery Act to advance the project. Funding planned for the outyears was reduced to maintain the same TPC. Work is ongoing to update the schedule to reflect the advanced funding profile. As of now, the planned completion for this project is still in 2014, but it is expected to be advanced.

Tokai-to-Kamioka (T2K) Near Detector is a new accelerator-based neutrino oscillation experiment in Japan. This experiment utilizes neutrino beams from the Japanese proton accelerator facility, measured both in a nearby detector and in the Super-Kamiokande detector approximately 300 km away, to study neutrino oscillations in a manner complementary to NOνA. This project was completed in FY 2009.

Accelerator Project for the Upgrade of the LHC (APUL) is a new MIE planned to begin fabrication in FY 2010. The scope of the project is to design and construct selected magnets, power systems, and beam instrumentation needed for increasing the LHC luminosity by a factor of two to three. The Mission Need was approved October 2008 and conceptual design is underway, funded under Other Project Costs. Brookhaven National Laboratory and Fermilab are expected to fabricate components and deliver them to CERN for installation in the LHC.

MicroBooNE is a new MIE planned to begin fabrication in FY 2011. The scope of the project is build a liquid argon neutrino detector to be used in the Booster neutrino beam at Fermilab for the measurement of low energy neutrino cross-sections. These cross sections will be measured at lower neutrino energy than the work planned for MINERνA and will be important for future neutrino oscillation experiments such as T2K and the proposed long baseline neutrino experiment for which PED funds are requested in FY 2011. This experiment will also be an important demonstration of efficacy of liquid argon time projection chambers as neutrino detectors.

Non-Accelerator Physics MIEs:

Reactor Neutrino Detector, located in Daya Bay, China, is being fabricated in partnership with research institutes in China. This experiment will use anti-neutrinos produced by commercial power reactors to precisely measure a fundamental parameter that will help resolve ambiguities in neutrino properties and will be input to setting future directions of neutrino research. A baseline change increasing the TPC from $34,000,000 to $35,500,000 with a planned completion date of April 2013 was approved January 2010. This baseline change was needed to accommodate delays in the civil construction being performed by our Chinese partners.

Dark Energy Survey (DES) project will provide the next step beyond the discovery of dark energy by making more detailed studies using several different observational methods. DOE is supporting the fabrication of a new camera to be installed and operated on the existing Blanco four-meter Telescope at the Cerro Tololo Inter-American Observatory (CTIO) in Chile. This project is a partnership between DOE and the NSF, which operates the telescope, along with international participation. The planned completion of this project is in FY 2011.

Super Cryogenic Dark Matter Survey (SuperCDMS) at Soudan is an upgrade of an existing dark matter search experiment (CDMS) to increase sensitivity for direct detection of dark matter over current experiments by a factor of three. The ultra-cold, supersensitive superconducting germanium detectors will be manufactured at Stanford University and tested at various U.S. institutions before being installed at the Soudan Underground Laboratory in Minnesota. This project has been reduced in size compared to the FY 2009 budget request in order to complete the experiment more quickly and maintain scientific competitiveness with other dark matter detection technologies.

Advanced Technology R&D MIEs:

Advanced Accelerator R&D Test Facility was initiated in FY 2009. Two proposals, Berkeley Lab Laser Accelerator (BELLA) Project at LBNL and the Facility for Accelerator Science and Experimental Test Beams (FACET) at SLAC were reviewed as candidates for this facility. Both received excellent reviews and using Recovery Act funds, both projects are proceeding. FACET received only Recovery Act funds and BELLA is funded with both FY 2009 funds and Recovery Act funds. FACET will fabricate equipment to be installed in the portion of the SLAC linac not utilized by Linac Coherent Light Source. It will support experiments on plasma wakefield acceleration of electrons, a technique that exploits the field created by one electron bunch moving through a plasma to accelerate a second bunch following in the wake of the first. The BELLA Project will utilize a 1 petawatt laser to produce the wakefields in the plasma, instead of a beam of electrons. The goal of the project is to produce 10 GeV electron beams in less than 1 meter of plasma. Both projects received CD-1 in September 2009. BELLA also received CD-2A/3A to approve procurement of the 1 petawatt laser.

Electron Beam Welder is a new MIE in FY 2011. This is a single procurement for a large piece of equipment needed in the processing of niobium superconducting RF cavities. Electron beam welding is the preferred method of welding niobium due to its very high melting point, approximately 4500° F, and the minimal size of the heat affected zone. The electron beam welder for Fermilab will be used to assemble and repair niobium superconducting cavities.

Construction Projects

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	Outyears	Total
Long Baseline Neutrino Experiment (PED)							
TEC	0	0	0	0	12,000	90,000	102,000
OPC	0	0	13,000	9,180	0	0	22,180
TPC	0	0	13,000	9,180	12,000	90,000	124,180
Muon to Electron Conversion Experiment (PED)							
TEC	0	0	0	0	5,000	30,000	35,000
OPC	0	0	0	5,000	5,000	0	10,000
TPC	0	0	0	5,000	10,000	30,000	45,000
Total Construction							
TEC		0	0	0	17,000		
OPC		0	13,000	14,180[a]	5,000		
TPC		0	13,000	14,180	22,000		

Scientific Employment

	FY 2009 estimate	FY 2010 estimate	FY 2011 estimate
# University Grants	200	200	200
# Laboratory Groups	45	45	45
# Permanent Ph.D.'s (FTEs)	1,150	1,140	1,140
# Postdoctoral Associates (FTEs)	600	550	550
# Graduate Students (FTEs)	605	595	595
# Ph.D.'s awarded	110	110	110

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[a] Other Project Costs for planned Construction activities in FY 2010 reflects the budget plan in the Mission Need statements for these projects. Critical Decision documentation was recently approved and the funding will be provided in the 2nd Quarter of FY 2010.

11-SC-40, Long Baseline Neutrino Experiment (LBNE), Fermi National Accelerator Laboratory, Batavia, Illinois

Project Data Sheet is for PED

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-0 that was approved January 8, 2010.

A Federal Project Director (FPD) has not been assigned to this project, but an FPD will be assigned by CD-1.

This PDS is new for PED. The FY 2011 request is for PED only.

2. Design, Construction, and D&D Schedule[a]

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2011	1/8/2010	1Q FY 2011	4Q FY 2013	TBD	TBD	TBD	TBD	TBD

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

3. Baseline and Validation Status[b]

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	102,000[c]	TBD	TBD	22,180[d]	TBD	TBD	TBD

4. Project Description, Justification, and Scope

The Long Baseline Neutrino Experiment (LBNE) will be composed of a neutrino beamline, a small near detector, and a large neutrino detector located a long distance from the neutrino beam. A neutrino beam designed to pass through earth is built in a downward sloping tunnel, like the Neutrinos at the Main Injector (NuMI) beam, and therefore requires the construction of an underground tunnel. This new beamline would provide low-energy neutrinos, a more intense beam, and point in a different direction from NuMI in order to provide the longer distance to the detector needed for the study of neutrino oscillations.

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[a] This project does not have CD-2 approval and is not requesting construction funds.

[b] This project is not yet baselined.

[c] This is a preliminary estimate for the planned PED over FY 2011–FY 2013.

[d] This is a preliminary estimate for Other Project Costs (OPC) including R&D, conceptual design, but not commissioning, and pre-operations.

Depending on the technology used, the detector may also need to be located underground to reduce the background from cosmic rays to a manageable level. The scope of work currently being developed includes: a neutrino beamline, one or more large neutrino detectors, the large underground cavern(s) needed to house the detector(s), and the infrastructure needed to support the construction and operation of the large detector underground.

The Particle Physics Project Prioritization Panel saw the Deep Underground Science and Engineering Laboratory (DUSEL), proposed by the National Science Foundation (NSF) to be a good match to the needs of a long baseline neutrino experiment. The Office of High Energy Physics (HEP) has been in discussions with the NSF Physics Division on cooperating during the development of these two initiatives, but will not commit to the DUSEL location for the long baseline neutrino experiment until the DOE alternatives analysis is completed, which is estimated to be early in FY 2011. Among the technical issues that need to be addressed in the alternatives analysis is the preferred detector technology. Two technologies are presently being considered: water Cerenkov and liquid argon time projection chamber. Water Cerenkov is a well established technology with more than 20 years of use, while liquid argon is a highly promising technology that could prove to be less expensive. Funding will be provided for R&D to answer a number of questions about liquid argon that will allow for a better comparison of the technologies.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Total Estimated Cost (TEC)				
PED				
FY 2011	12,000	12,000	0	10,000
FY 2012	35,000	35,000	0	34,000
FY 2013	55,000	55,000	0	50,000
FY 2014	0	0	0	8,000
Total, PED	102,000	102,000	0	102,000
Other Project Cost (OPC)				
OPC except D&D				
FY 2009 Recovery Act	13,000	13,000	0	0
FY 2010	9,180	9,180	13,000	7,000
FY 2011	0	0	0	2,180
Total, OPC except D&D	22,180	22,180	13,000	9,180
Total Project Cost (TPC)				
FY 2009 Recovery Act	13,000	13,000	0	0
FY 2010	9,180	9,180	13,000	7,000

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
FY 2011	12,000	12,000	0	12,180
FY 2012	35,000	35,000	0	34,000
FY 2013	55,000	55,000	0	50,000
FY 2014	0	0	0	8,000
Total, TPC	124,180	124,180	13,000	111,180

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	75,000	N/A	N/A
Contingency	27,000	N/A	N/A
Total, PED	102,000	N/A	N/A
Total, TEC	102,000	N/A	N/A
Contingency, TEC	27,000	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	2,000	N/A	N/A
Conceptual Planning	7,000	N/A	N/A
Conceptual Design	9,000	N/A	N/A
Contingency	4,180	N/A	N/A
Total, OPC except D&D	22,180	N/A	N/A
Contingency, OPC	4,180	N/A	N/A
Total, TPC	124,180	N/A	N/A
Total, Contingency	31,180	N/A	N/A

7. Funding Profile History

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2011[a]	TEC	0	0	0	0	12,000	35,000	55,000	0	0	102,000
	OPC	0	0	13,000	9,180	0	0	0	0	0	22,180
	TPC	0	0	13,000	9,180	12,000	35,000	55,000	0	0	124,180

8. Related Operations and Maintenance Funding Requirements

Not applicable for PED.

9. Required D&D Information

Not applicable for PED.

10. Acquisition Approach

The conceptual design and study of alternatives is being led by Fermi National Accelerator Laboratory with the assistance of Brookhaven National Laboratory. This work will be used to develop an Acquistion Strategy that will be approved as part of CD-1. At this time it is expected that a new neutrino beamline and neutrino detector will be needed. The technical expertise needed to design and build these components is very specialzed and will limit the acquisition approaches.

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[a] This project has not yet received CD-2 approval and this is the first request for PED funds. Only PED and OPC excluding D&D are shown.

11-SC-41, Muon to Electron Conversion Experiment (Mu2e), Fermi National Accelerator Laboratory, Batavia, Illinois
Project Data Sheet is for PED

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-0 was approved November 24, 2009.

A Federal Project Director has not yet been assigned to this project, but will be by CD-1.

This PDS is new for PED. The FY 2011 request is for PED only.

2. Design, Construction, and D&D Schedule[a]

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2011	11/24/2009	4Q FY 2010	4Q FY 2012	TBD	TBD	TBD	TBD	TBD

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

3. Baseline and Validation Status[b]

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	35,000[c]	TBD	TBD	10,000[d]	TBD	TBD	TBD

4. Project Description, Justification, and Scope

The conversion of a muon to an electron (Mu2e) in the field of a nucleus provides a unique window on the structure of potential new physics discoveries and allows access to new physics at very high mass scales. The Particle Physics Project Prioritization Panel (P5) identified this opportunity as a top priority for the Intensity Frontier of particle physics.

This project will construct a new beamline to take protons from the existing 8 GeV Booster synchrotron at Fermilab to a muon production target, a beamline to transport those muons to the detector, a low-mass magnetic spectrometer, which can measure the electron momentum with a resolution of order 0.15%, and a new experimental hall to house the muon production target, muon beamline, and the detector.

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[a] This project does not have CD-2 approval and is not requesting construction funds.
[b] This project is not yet baselined.
[c] This is a preliminary estimate for the planned PED in FY 2011 and FY 2012.
[d] This is a preliminary estimate for the OPC including R&D, conceptual design, but not commissioning, and pre-operations.

This project is very close to being completely ready technically for construction. The only needed R&D that has been identified is work on heating of the muon production target with an estimated cost of $150,000.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

	(dollars in thousands)		
	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED			
FY 2011	5,000	5,000	4,500
FY 2012	30,000	30,000	20,000
FY 2013	0	0	10,500
Total, PED	35,000	35,000	35,000
Other Project Cost (OPC)			
OPC except D&D			
FY 2010	5,000	5,000	4,500
FY 2011	5,000	5,000	5,500
Total, OPC except D&D	10,000	10,000	10,000
Total Project Cost (TPC)			
FY 2010	5,000	5,000	4,500
FY 2011	10,000	10,000	10,000
FY 2012	30,000	30,000	20,000
FY 2013	0	0	10,500
Total, TPC	45,000	45,000	45,000

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	28,000	N/A	N/A
Contingency	7,000	N/A	N/A
Total, PED	35,000	N/A	N/A
Total, TEC	35,000	N/A	N/A
Contingency, TEC	7,000	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	150	N/A	N/A
Conceptual Planning	3,850	N/A	N/A
Conceptual Design	4,000	N/A	N/A
Contingency	2,000	N/A	N/A
Total, OPC except D&D	10,000	N/A	N/A
Contingency, OPC	2,000	N/A	N/A
Total, TPC	45,000	N/A	N/A
Total, Contingency	9,000	N/A	N/A

7. Funding Profile History

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2011[a]	TEC	0	0	0	5,000	30,000	0	0	0	35,000
	OPC	0	0	5,000	5,000	0	0	0	0	10,000
	TPC	0	0	5,000	10,000	30,000	0	0	0	TBD

8. Related Operations and Maintenance Funding Requirements

Not applicable for PED.

9. Required D&D Information

Not applicable for PED.

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[a] This project has not yet received CD-2 approval and this is the first request for PED funds. Only PED and OPC excluding D&D are shown.

10. Acquisition Approach

The conceptual design is being peformed by Fermilab, and it will inform the acquisition approach that will be documented in the Acquistion Strategy required for CD-1. It is already known that beamlines, detectors, and an experimental hall will be needed, and that the specialized expertise in those areas will be limit the range of acquisition options.

Nuclear Physics
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Nuclear Physics				
Medium Energy Nuclear Physics	116,873	+15,390	127,590	129,610
Heavy Ion Nuclear Physics	194,957	+12,669	212,000	218,435
Low Energy Nuclear Physics	94,880	+29,667	114,636	113,466
Nuclear Theory	37,776	+17,237	41,574	44,709
Isotope Development and Production for Research and Applications[b]	24,760	+14,837	19,200	19,780
Subtotal, Nuclear Physics	469,246	+89,800	515,000	526,000
Construction	31,061	+65,000	20,000	36,000
Total, Nuclear Physics	500,307[c]	+154,800	535,000	562,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 101–101, "1989 Energy and Water Development Appropriations Act," establishing the Isotope Production and Distribution Program Fund)
Public Law 103–316, "1995 Energy and Water Development Appropriations Act," amending the Isotope Production and Distribution Program Fund to provide flexibility in pricing without regard to full-cost recovery
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The mission of the Nuclear Physics (NP) program is to discover, explore, and understand all forms of nuclear matter. The fundamental particles that compose nuclear matter—quarks and gluons—are relatively well understood, but exactly how they fit together and interact to create different types of matter in the universe is still largely not understood. To solve this mystery, NP supports experimental and theoretical research—along with the development and operation of particle accelerators and advanced technologies—to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer found naturally.

Background

It is one of the enduring mysteries of the universe: What, really, is matter? What are the units that matter is made of, and how do they fit together to give matter the properties we observe? These are questions which philosophers have wrestled with for millennia. Twenty-four hundred years ago, the Greek philosopher Democritus suggested that if one were to divide matter into smaller and smaller pieces, one would eventually be left with indivisible entities called atoma. It was not until the 1800s, however, that scientists had solid evidence that such atoma—or atoms—actually existed, and it was not until the early 1900s that techniques were developed that made it possible to examine their composition.

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[a] The Recovery Act Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] The Isotope Development and Production for Research and Applications program was transferred to the Office of Science from the Office of Nuclear Energy in FY 2009.

[c] Total is reduced by $11,773,000: $10,512,000 of which was transferred to the Small Business Innovative Research (SBIR) program and $1,261,000 of which was transferred to the Small Business Technology Transfer (STTR) program.

In 1909 the physicist Ernest Rutherford fired a beam of helium ions at a thin sheet of gold foil and measured how the ions scattered, showing that each atom has at its center, a small, dense, positively charged core, which Rutherford named the nucleus. Scientists later determined that the nucleus is surrounded by a cloud of tiny negatively charged electrons that account for less than 0.1% of the total mass of the atom. Upon closer inspection, researchers found that the nucleus was composed of even smaller particles: the positively charged proton and the electrically neutral neutron. Research showed that protons and neutrons are bound in the nucleus by a fundamental force named the strong force because it is far stronger than either gravity or electromagnetism, although it operates on smaller distance scales. As scientists delved further into the properties of the proton and neutron, they discovered that each proton and neutron is composed of three tiny particles called quarks. Quarks are bound together by yet other particles called gluons, which are believed to be the generators of the strong force. One of the major goals of nuclear physics is to understand precisely how quarks and gluons bind together to create protons, neutrons, and other hadrons (the generic name for particles composed of quarks) and, in turn, to determine how all hadrons fit together to create nuclei and other types of matter.

The quest to understand matter takes place through theory and experiment, with both being necessary to develop a full understanding of the properties and behavior of matter. In the theoretical approach, scientists have developed a precise mathematical description of how the quarks and gluons in nuclear matter interact, referred to as Quantum Chromodynamics (QCD). On the experimental side, scientists accumulate a great deal of experimental data about the behavior of quarks and gluons as well as protons, neutrons, and nuclei in a variety of settings. Unlike Rutherford's table-top experiment, most of the experiments today require large facilities spanning acres. These particle accelerators slam bits of matter into each other, and scientists observe the results. The main differences from Rutherford's time are the ability to accelerate the bits of matter to much higher speeds, the variety of types of matter that can be used, and the sophistication of the instruments used in the observations. The careful integration and comparison of experimental measurements with theoretical calculations provides both insight into the behavior of matter and the information needed to test the validity of theoretical models.

Nuclear physics seeks to understand matter in all of its manifestations—not just the familiar forms of matter we see around us, but also such exotic forms as the matter that existed in the first moments after the creation of the universe and the matter that exists today inside neutron stars—and to understand why matter takes on the particular forms that it does. Nuclear physics has come to focus on three broad yet tightly interrelated areas of inquiry. These three areas are described in *The Frontiers of Nuclear Science*[a], a long range plan for nuclear science released in 2007 by the Nuclear Science Advisory Committee (NSAC). The plan represents a consensus within the nuclear science community about compelling scientific thrusts. The three frontiers the long range plan identified are:

- **Quantum Chromodynamics:** The focus of this frontier is to develop a complete understanding of how quarks and gluons assemble themselves into the various forms of matter and, as part of that process, to search for yet undiscovered forms of matter. While nuclear scientists want to know how quarks and gluons assemble to form matter, they also want to understand what happens when nucleons "melt." QCD predicts that nuclear matter can change its state in somewhat the same way that ordinary matter can change from solid to liquid to gas. This can happen when nucleons are compressed well beyond the density of atomic nuclei, as in the core of a neutron star, or when they are heated to the kind of extreme temperatures found in the early universe. One of the most startling recent discoveries is the creation of a new form of matter, thought to have existed only moments after the birth of the universe under conditions of extreme temperature and density, and the fact that it behaves as an almost perfect liquid instead of a dilute gaseous plasma as originally hypothesized.

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[a] http://www.sc.doe.gov/np/nsac/nsac.html

- **Nuclei and Nuclear Astrophysics:** Nuclear physicists seek to understand how protons and neutrons combine to form atomic nuclei and how these nuclei have arisen during the 13.7 billion years since the birth of the cosmos. The forces that bind protons and neutrons together into nuclei are immensely strong, with the result being that nuclear processes such as nuclear fusion and fission can release huge amounts of energy. Looking inward, nuclear scientists seek a comprehensive description of the behavioral characteristics of multi-nucleon systems and marginally stable exotic nuclei not naturally found on earth. Looking outward, nuclear scientists seek to understand the nuclear processes that have shaped the cosmos, from the origin of the elements, the evolution of stars, and the detonation of supernovae, to the structure of neutron stars and the nature of matter at extreme densities. Nuclear scientists have made great strides in nuclear astrophysics, for example by decreasing the limits of the age of the universe by about one billion years through studies of the reaction cross sections that control hydrogen burning in stars.
- **Fundamental Symmetries and Neutrinos:** Although the strong force plays the dominant role in the nucleus, it is not the only force that nuclear physicists must consider. Because protons (and quarks) are electrically charged, electromagnetism comes into play in such circumstances as proton-proton interactions, and the weak force is responsible for the transformation of protons into neutrons and vice versa. The three forces have been unified by a single theory, referred to as the Standard Model, which does an excellent job of explaining the interactions of the various fundamental particles. However, certain inadequacies of that theory have led physicists to begin developing a New Standard Model. In particular, nuclear physicists are interested in developing a better understanding of the fundamental properties of the neutron and of the neutrino, the nearly undetectable fundamental particle produced by the weak interaction that was first indirectly detected in nuclear beta decay. One of the most surprising results to come out of neutrino studies in the past decade was the discovery that electron neutrinos produced in the Sun are changing into a different type of neutrino, thus explaining the puzzling shortage of events seen in previous solar neutrino detectors and confirming models for solar energy production.

For over 50 years, this program and its predecessors have been at the forefront of the development and production of stable and radioactive isotope products that are now used world-wide. DOE applies its unique expertise and capabilities to address technology issues associated with the application, production, handling, and distribution of isotopes. Adequate supplies of medical and research isotopes are essential to maintain effective diagnosis, treatment, and research capabilities in the U.S. The program's products and services are sold to over 20 countries. The program produces isotopes only where there is no U.S. private sector capability or other production capacity is insufficient to meet U.S. needs.

Subprograms

To accomplish its mission and address the scientific challenges described above, the Nuclear Physics program is organized into five subprograms: Medium Energy Nuclear Physics, Heavy Ion Nuclear Physics, Low Energy Nuclear Physics, Nuclear Theory, and Isotope Development and Production for Research and Applications.

- The *Medium Energy* subprogram primarily explores the frontier of QCD with research conducted at two NP national user facilities and other facilities worldwide. The Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF or TJNAF) provides high quality beams of polarized electrons that allow scientists to extract information on the quark and gluon structure of protons and neutrons. CEBAF also uses polarized electrons to make precision measurements of parity violating processes that can provide information relevant to the development of the New Standard Model. The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) provides colliding beams of spin-polarized protons to probe the spin structure of the proton, another important aspect of the QCD frontier. This subprogram supports one of six of the Nuclear Physics program's university Centers of Excellence that has infrastructure capabilities to develop advanced instrumentation and accelerator equipment.
- The *Heavy Ion* subprogram also investigates the frontier of QCD, but with a different approach—by trying to recreate and characterize new and predicted forms of matter and other new phenomena that might occur in extremely hot, dense nuclear matter and which have not existed since the Big Bang. Measurements are carried out primarily using relativistic heavy ion collisions at RHIC. Participation in the heavy ion program at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) provides U.S. researchers the opportunity to search for new states of matter under substantially different initial conditions than those provided by RHIC, yet still provide information regarding the matter that existed during the infant universe.
- The *Low Energy* subprogram studies two nuclear science frontiers—Nuclear Structure and Astrophysics and Fundamental Symmetries and Neutrinos. Two NP national user facilities are pivotal in making progress in these frontiers. The Argonne Tandem Linac Accelerator System (ATLAS) at Argonne National Laboratory (ANL) is used to study questions of nuclear structure by providing high-quality beams of all the stable elements up to uranium and selected beams of short-lived nuclei for experimental studies of nuclear properties under extreme conditions and reactions of interest to nuclear astrophysics. The Holifield Radioactive Ion Beam Facility (HRIBF) at Oak Ridge National Laboratory (ORNL) provides beams of short-lived radioactive nuclei that scientists use to study exotic nuclei that do not normally exist in nature. HRIBF is also used to explore reactions of interest to nuclear astrophysics. The future Facility for Rare Isotope Beams (FRIB) at Michigan State University (MSU) is a next-generation machine that will advance the understanding of rare nuclear isotopes and the evolution of the cosmos. The subprogram also supports four university Centers of Excellence, three with unique low energy accelerator facilities and one with infrastructure capabilities for developing advanced instrumentation. These university Centers of Excellence provide outstanding hands-on science, technology, and engineering educational opportunities for students at various stages in their career. In addition, the program partners with the National Reconnaissance Office and the United States Air Force to support limited operations of the 88-Inch Cyclotron at the Lawrence Berkeley National Laboratory (LBNL) for a small in-house research program and to meet national security needs.
- Finally, within the portfolio of this subprogram are experiments designed to develop a better understanding of the properties of neutrinos and, in particular, of their masses. This science is typically explored with large detectors sited underground to shield them from cosmic background radiation so that they can detect rare particle signals. Measurements of symmetry properties, particularly the symmetry properties of the neutron, are carried out by nuclear physicists at the Spallation Neutron Source (SNS) at ORNL.
- The *Nuclear Theory* subprogram provides the theoretical underpinning needed to support the interpretation of a wide range of data obtained from all the other nuclear science subprograms and to

advance new ideas and hypotheses that stimulate experimental investigations. This subprogram supports the one of the program's university Centers of Excellence, the Institute for Nuclear Theory (INT) at the University of Washington where leading nuclear theorists are assembled from across the Nation to focus on key frontier areas in nuclear physics. The subprogram also collects, evaluates, and disseminates nuclear physics data for basic nuclear research and for applied nuclear technologies with its support of the National Nuclear Data Center (NNDC). The extensive nuclear databases produced by this effort are an international resource consisting of carefully organized scientific information gathered from over 50 years of low-energy nuclear physics research worldwide.

- The *Isotope Development and Production for Research and Applications* subprogram supports the production and development of production techniques of radioactive and stable isotopes that are in short supply. Isotopes are high-priority commodities of strategic importance for the Nation and are essential for energy, medical, national security, and basic research. A goal of the program is to make critical isotopes more readily available to meet domestic U.S. needs. This subprogram is steward of the Isotope Production Facility (IPF) at Los Alamos National Laboratory (LANL), the Brookhaven Linac Isotope Producer (BLIP) facility at BNL, and hot cell facilities for processing isotopes at ORNL, BNL, and LANL. The subprogram also coordinates and supports isotope production at a suite of university, other national laboratory, and commercial accelerator and reactor facilities throughout the Nation to promote a reliable supply of domestic isotopes. The National Isotope Data Center (NIDC) at ORNL interfaces with the user community and manages the coordination of isotope production across the many facilities and the business operations of the sale and distribution of isotopes.

Benefits

NP supports a wide range of facilities, instruments, and research that create forefront scientific knowledge and state-of-the-art tools to serve the Nation. Nuclear science basic research and the advancement of knowledge of nuclear matter and its properties are inherently relevant to and intertwined with a broad range of applications including nuclear power, waste disposal, nuclear medicine, commerce, medical physics, space exploration, finance, geology, environmental sciences, and national security. The NP program develops advanced instrumentation, accelerator technologies, and analytical and computational techniques that are needed for nuclear science research and which have broad societal and economic benefits, and supports reliable, timely, and economical delivery of stable and radioactive isotopes for commercial application and research. The development and construction of facilities and advanced instrumentation and accelerator technology needed to reach performance goals of the program not only contribute technically to other research and applied sciences, but educate a next generation of scientists and help to create technical and engineering jobs.

History shows that research into the nucleus has led to a number of valuable applications with practical benefits to society. The realization that the nucleus contains a tremendous amount of energy led to the development of both nuclear power and the atomic bomb. Some of the cutting-edge instrumentation being developed for nuclear physics experiments, such as high-resolution gamma ray detectors, can provide improved imaging techniques with important applications in combating terrorism. The discovery and understanding of nuclear spin made possible the development of magnetic resonance imaging for medical use. Medical imaging, cancer therapy, and biochemical studies all rely on isotopes produced in accelerators that were first developed for nuclear research. Particle beams are used for cancer therapy and in a broad range of materials science studies.

Valuable applications have resulted from isotope availability and nuclear radiation, which made possible the entire field of nuclear medicine used today in both the diagnosis and treatment of disease.

Enhancements in isotope production and processing techniques has fueled the development of new isotopes, including those for heart and lung imaging, cancer therapy, smoke detectors, neutron detectors, special nuclear material and explosive detection, oil exploration, industrial radiography, and tracers for climate change research. The various applications resulting from isotope availability have improved the ability of physicians to diagnose illnesses and improved the quality of life and longevity for innumerable patients and strengthened national security.

Yet another societal benefit of the NP program is the boost to the Nation's R&D workforce through its support of undergraduate researchers, graduate students working toward an advanced degree, and postdoctoral associates developing their research and management expertise. These researchers provide new talent in research and help meet the demand for skilled personnel in a wide variety of technical, medical, security, and industrial fields that require the unique problem-solving abilities and the computational and technical skills developed through an education and experience in nuclear science. Each year several national laboratory junior scientists within the NP program have been recognized with Presidential Early Career Awards for Scientists and Engineers for their outstanding contributions to nuclear and accelerator physics research and their promise as future leaders of the field. In FY 2009, three junior laboratory researchers at BNL, TJNAF, and LANL were recognized for their efforts by receiving this prestigious award. Approximately half of the scientists trained as nuclear physicists are found in such diverse areas as energy, nuclear medicine, commerce, medical physics, space exploration, finance, and national security.

Program Planning and Management

To ensure that funding is allocated as effectively as possible, the NP program has developed a rigorous and comprehensive system of planning and priority setting that relies heavily on input from groups of outside experts. All activities within the subprograms are peer reviewed and performance is assessed on a regular basis. Priority is given to those research activities which support the most compelling scientific opportunities. NP has also instituted a number of peer review and oversight measures designed to assess productivity and maintain effective communication and coordination among participants in NP activities. On an as-needed basis, the program has taken the initiative to establish working groups amongst federal agencies to tackle issues of common interest and enhance communication. The NP program takes all of this input into account in its budget requests, making decisions to maximize scientific impact, productivity, quality, and cost-effectiveness within the resources available.

The NP program works closely with NSF to jointly charter the Nuclear Science Advisory Committee (NSAC) for advice regarding compelling opportunities and productivity of the national nuclear science program. NP develops its strategic plan for the field with input from the scientific community via long range plans produced by NSAC every five to six years. These plans perform retrospective assessments of major accomplishments, assess and identify scientific opportunities, and set priorities for the next decade. NSAC provides NP with additional guidance in the form of reviews of subfields, special interest topics, and assessment of the management of the NP program itself. NSAC completed a report in April 2009 that identifies *Compelling Research Opportunities Using Isotopes,*[a] and a second report, issued in November 2009, lays out a strategic plan for the Isotope Development and Production for Research and Applications subprogram, *Isotopes for the Nation's Future—A Long Range Plan.*[a] NSAC's most recent charge is to conduct a Committee of Visitors (COV) review of NP management processes in FY 2010.

NP strategic plans are also influenced by National Academies reports, Office of Science and Technology Policy (OSTP) and National Security Council (NSC) Interagency Working Group (IWG) efforts, the latter two under the auspices of the Executive Office of the President. The 2007 National Academies study *Advancing Nuclear Medicine through Innovation*[a] motivated NP to establish a federal working group with the National Institutes of Health (NIH), along with the Office of Science (SC) Biological and Environmental Research program, to better coordinate radioisotope production and to address other issues important to nuclear medicine. The National Academies embarked on a new decadal study of nuclear science in 2009. In order to optimize interagency activities, NP is involved in four OSTP or NSC IWG's: *Large Scale Science, Forensic Science, Molybdenum-99 Production,* and *The Physics of the Universe.*

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[a] http://www.sc.doe.gov/np/nsac/nsac.html

NP peer reviews all of its activities. Annual science and technology reviews of the national user facilities and isotope production facilities with panels of international peers assess operations, performance, and scientific productivity. These results influence budget decisions and NP's assessment of laboratory performance as documented in annual SC laboratory appraisals. The peer reviews result in recommendations and the institutions are held accountable for responding to them. Annual reviews of instrumentation projects, conducted by experts, focus on scientific merit, technical status and feasibility, cost and schedule, and effectiveness of management approach. The NP program conducted 22 such reviews with panels of national and international experts in FY 2009. Performance of instrumentation projects are also assessed on a monthly and quarterly basis.

One of the most pressing priority-setting issues at the national user facilities is how to allocate available beam time, or time spent doing experiments on a facility's accelerator. Facility directors seek advice from Program Advisory Committees to determine the allocation of this scarce scientific resource. The Program Advisory Committees review research proposals requesting resources and time at the facilities and then provide advice on the scientific merit, technical feasibility, and personnel requirements of the proposals.

University grants are proposal driven. The NP program funds the best and most promising of those ideas submitted in response to grant solicitation notices. Proposals are reviewed by external scientific peers and competitively awarded according to the guidelines published in 10 CFR 605. The quality and productivity of university grants are peer reviewed on a three-year basis. Laboratory groups performing research are peer reviewed on a four-year basis to examine the quality of research and to identify needed changes, corrective actions, or redirections of effort. Funding decisions in this budget request are influenced by the results of these periodic peer reviews of the national laboratory research efforts. The most recent review of laboratory research groups was in 2009 for the Nuclear Theory subprogram.

Basic and Applied R&D Coordination

The knowledge, data, techniques, and methods of nuclear science are utilized in a broad portfolio of applications, including nuclear power, waste disposal, nuclear medicine, commerce, medical physics, space exploration, finance, geology, environmental sciences, national security, and others. In FY 2009, NP initiated support for targeted initiatives in Applications of Nuclear Science and Technology, the primary goal of which is to pursue forefront nuclear science research and development important to the NP mission, but inherently relevant to applications. One of the goals of this initiative was to help bridge the gap between basic research and applied science. The response to the first solicitation to this initiative in FY 2009 was extremely successful, with over 200 proposals submitted. A total of 22 awards were made with a combination of appropriated base funding and Recovery Act funds. The proposals supported include nuclear physics research that is relevant to the development of advanced fuel cycles for next generation nuclear power reactors; advanced and cost-effective accelerator technology and particle detection techniques for medical diagnostics and treatment; and research in developing neutron, gamma and particle beam sources with applications in cargo screening and nuclear forensics. These initiatives are peer reviewed with participation from the applied sciences community. The integration of the underpinning nuclear science advances, resulting from innovative basic research with the applied sciences will optimize communication, cost effectiveness, performance, and technology transfer.

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[a] http://dels.nas.edu/dels/rpt_briefs/advancing_nuclear_medicine.pdf

The Isotope Development and Production for Research and Applications subprogram is an excellent example of basic and applied R&D coordination. The subprogram produces commercial and research isotopes that are important for basic research and applications. NP has taken significant steps in aligning the industrial and research stakeholders of the isotope program with each other and with the nuclear science research community, all of whom can contribute collectively in advancing the technology of this field. To ascertain current and future demands of the research community, NP continues to develop working groups with other federal agencies, foster interactions between researchers and Isotope Program staff, obtain data from site visits, attend society exhibitions, and develop strategic plans and priorities with community input. Recent examples include: forming a DOE and National Institutes of Health (NIH) federal working group to address the recommendations of the recent National Academies report, *Advancing Nuclear Medicine through Innovation*, which identified several areas in isotope production warranting attention; attending the Society of Nuclear Medicine annual meeting in Toronto in June 2009 and sponsoring a workshop dedicated to the use and production of alpha-emitters in medicine; and working with industry to define a path forward for ensuring the long-term availability of californium-252, an isotope of strategic and economic importance to the Nation. NP is also establishing cooperative isotope supply contracts with universities to increase the Department's ability to meet researchers' requests by improving product availability and reliability.

The Isotope Development and Production for Research and Applications subprogram also supports research for the development of alternative production and extraction techniques of stable and radioactive isotopes and the production of research isotopes identified by NSAC as needed for high priority research opportunities across a broad range of scientific disciplines.

Budget Overview

NP is the largest federal steward for basic research in nuclear science, operating four national user facilities, as well as supporting isotope production and development for the Nation. The FY 2011 budget appropriation is designed to optimize, within these resources and in the context of peer review, the scientific productivity of the program by ensuring a proper balance of research, facility operations, and investments in advanced technology and capabilities. The increase of $27,000,000 over the FY 2010 appropriation includes a $16,000,000 increase in the baselined funding profile for the 12 GeV CEBAF Upgrade project, an increase in operations of the RHIC facility, and an increase to the rest of the NP program of about 2 percent relative to FY 2010 to maintain research efforts. The completion of the 12 GeV Upgrade is identified by NSAC as the highest priority for the field.

The heart of the program is the group of highly trained scientists who conceive, plan, execute, and interpret the numerous experiments carried out at various nuclear physics facilities. NP supports scientists at both universities and national laboratories and is involved in a variety of international collaborations. The program supports approximately two-thirds of the Nation's university researchers and graduate students who are doing fundamental nuclear physics research. More than 2,000 researchers and students at approximately 100 U.S. academic, federal, and private-sector institutions are supported. With the FY 2011 request, research activities are conducted at approximately 90 academic institutions located in 35 states and the District of Columbia, as well as at 9 DOE laboratories in 8 states. Approximately 80 Ph.D. degrees are granted annually to students for research supported by the program.

Six university Centers of Excellence provide excellent hands-on training opportunities for junior scientists. The Outstanding Junior Investigator (OJI) program, initiated in FY 2000, made approximately three new awards each year to early career tenure-track faculty through FY 2009 and has been very successful in identifying, recognizing, and supporting promising junior university faculty and future leaders of the field.

Research at nine national laboratories is guided by the DOE mission and priorities and is the underpinning of strategic core competencies needed for the NP program. The national laboratory scientists work and collaborate with academic scientists, other national laboratory experimental researchers, and those carrying out theoretical investigations. The national laboratory scientists collect and analyze data as well as support and maintain the detectors and facilities used in these experiments. The national laboratories also provide state-of-the-art resources for detector and accelerator R&D for future upgrades and new facilities.

Investigating the frontiers of nuclear physics requires being able to accelerate various particles, such as protons, electrons, or a variety of ions, up to nearly the speed of light, smashing them into other particles, and then observing the results of the collisions. Exploring the various areas of nuclear physics demands having a variety of accelerators, each designed to examine the subatomic world in its own unique way and employing a variety of particle detectors and other equipment. Thus, NP supports a suite of facilities that complement one another and provide a variety of approaches to producing and collecting data about matter at the level of the nucleus, as well as the sub-nuclear level. The necessary facilities and equipment are large, complex, and expensive to build and operate, and thus they account for a significant portion of the program's budget—approximately 65 percent of the FY 2011 request. It is the planned project profiles that typically drive the funding increases within the NP federal budget requests. NP also supports collaborative work at foreign accelerator facilities, as well as joint development of instrumentation.

NP supports four national user facilities (RHIC, CEBAF, ATLAS, and HRIBF), each with capabilities found nowhere else in the world, that provide research time for scientists at universities and other federal laboratories. These major scientific facilities provide research beams for a user community of approximately 3,300 scientists from all over the world, with more than 2,500 of the users utilizing RHIC and CEBAF. Approximately 40 percent of the users are from institutions outside of the U.S., and they often provide experimental equipment or instrumentation. A number of other SC programs, DOE offices (National Nuclear Security Administration and Nuclear Energy), federal agencies (NSF, NASA, and Department of Defense), and industries use the NP user facilities to carry out their own research programs.

The FY 2011 budget request will support near optimal levels of operations at the national user facilities allowing progress towards achieving performance goals defined by the 2008 *Report to NSAC of the Subcommittee on Performance Measures*[a] for nuclear science. The facilities will provide an estimated 18,910 hours of beam time for research, a decrease of about 650 hours compared with the anticipated beam hours in FY 2010 due to a planned shutdown period at CEBAF associated with the construction of the 12 GeV CEBAF Upgrade project at TJNAF. The major scientific user facilities will be maintained and operated so that the unscheduled operational downtime will be kept to less than 20 percent, on average, of total scheduled operating time. Investments will be made in programmatic infrastructure, facility equipment, and accelerator improvement projects that will increase productivity, reliability, and cost-effectiveness, and provide new capabilities to pursue high discovery science.

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[a] http://www.sc.doe.gov/np/nsac/nsac.html

Construction of the 12 GeV CEBAF Upgrade project continues in FY 2011. The FY 2011 request reflects the final adjustment to the original planned funding profile to account for the advanced funding provided in FY 2009 under the Recovery Act. This project is the highest priority in the NSAC Long Range Plan for Nuclear Science. The 12 GeV CEBAF Upgrade project is expected to create over 500 jobs that are related to the construction of the project. Because the project is of high priority, over $50,000,000 is redirected from the base CEBAF program towards the construction over the lifetime of the project.

Approximately 2 percent of the total NP budget in FY 2011 is invested in a handful of ongoing small-scale Major Items of Equipment (MIE) projects, each less than $20,000,000, in order to position the program strategically for the future to address compelling scientific opportunities identified by NSAC. The majority of these MIEs are collaborative in nature, with the DOE investment leveraged by contributions from other agencies and international partners. In FY 2010, conceptual design, NEPA activities, and R&D are supported for the proposed Facility for Rare Isotope Beams (FRIB), a next-generation nuclear structure and astrophysics machine that will map out the nuclear landscape. This project is supported with operating funds through a Cooperative Agreement with MSU. Although the FRIB property will not be a capital asset to the federal government and will be owned by the university, FRIB will be operated as a DOE national user facility upon completion. In FY 2011, funds are requested for engineering and design activities for FRIB. The FRIB project is expected to create approximately 800 jobs in the state of Michigan during the course of construction.

All of the NP subprograms benefited from Recovery Act funding. In Medium Energy support was provided for: advance funding of the 12 GeV CEBAF Upgrade project to accelerate procurements and reduce cost and schedule risk ($65,000,000); an accelerator improvement project at CEBAF to enhance facility capability ($2,760,000); and infrastructure improvements at TJNAF to accomplish backlogged projects ($10,000,000). In Heavy Ion support was provided for: completion of the PHENIX Silicon Vertex and Forward Vertex Major Items of Equipment (MIEs) ($2,250,000); and accelerator improvement projects to increase the luminosity of the RHIC collider beams ($8,000,000). In Low Energy support was provided for: completion of the Fundamental Neutron Physics Beamline MIE ($600,000); accelerator improvement projects at HRIBF, ATLAS and the 88-Inch Cyclotron to enhance facility capabilities ($14,240,000); and research under the Applications of Nuclear Science and Technology solicitation ($11,420,000). In Nuclear Theory support was provided for: workforce succession planning for the National Nuclear Data Program ($1,944,000); augmentation of the LQCD computing capabilities at TJNAF ($4,965,000); and research under the Applications of Nuclear Science and Technology solicitation ($8,020,000). In Isotope Development and Production for Research and Applications support was provided for: an initiative to support R&D on the development of alternative and innovative approaches for the development and production of critical isotopes ($4,617,000); and utilization of isotope production facilities, which included additional operations for the production of isotopes, one-time investments to improve the efficiency or provide new capabilities for the production of isotopes, and opportunities to establish production capabilities at new production sites ($10,000,000).

Significant Program Shifts

There are no significant shifts in the Nuclear Physics program in FY 2011.

Annual Performance Targets and Results

Secretarial Priority: Innovation: Lead the world in science, technology, and engineering.

GPRA Unit Program Goal: Nuclear Physics Program Goal: *Explore Nuclear Matter—from Quarks to Stars—Understand the evolution and structure of nuclear matter, from the smallest building blocks, quarks and gluons, to the stable elements in the Universe created by stars; to unique isotopes created in the laboratory that exist at the limits of stability and possess radically different properties from known matter.*

NP contributes to this Secretarial Priority and GPRA goal through strategic investments in science for discovery, science for national need, and national scientific user facilities—the 21st century tools for science, technology, and engineering. NP supports scientific research to discover, explore and understand all forms of nuclear matter focused on three strategic themes:

- Developing a complete understanding of how quarks and gluons assemble themselves into the various forms of nuclear matter, and searching for as yet undiscovered forms of matter.
- Understanding how protons and neutrons combine to form atomic nuclei, and how these nuclei have arisen since the birth of the cosmos.
- Developing a better understanding of the fundamental properties of the neutron and the neutrino, and exploring the implications of their properties for the Standard Model of fundamental particle and interactions.

The following indicators establish specific long-term goals in Scientific Discovery that NP is committed to, and progress can be measured against:

- Make precision measurements of fundamental properties of the proton, neutron, and simple nuclei for comparison with theoretical calculations to provide a quantitative understanding of their quark substructure;
- Create brief, tiny samples of hot, dense nuclear matter to search for the quark-gluon plasma and characterize its properties;
- Investigate new regions of nuclear structure, study interactions in nuclear matter like those occurring in neutron stars, and determine the reactions that created the nuclei of atomic elements inside stars and supernovae; and
- Measure fundamental properties of neutrinos and fundamental symmetries by using neutrinos from the sun and nuclear reactors and by using radioactive decay measurements.

Annual Performance Measure: Achieve at least 80% of the integrated delivered beam used effectively for all experiments run at each of the Argonne Tandem Linac Accelerator System (ATLAS) and the Holifield Radioactive Ion Beam (HRIBF) facilities measured as a percentage of the scheduled delivered beam considered effective for each facility.[a]

FY 2009	T: ≥ 80% A: Goal not met. ATLAS met the goal by achieving 92.4% of the integrated delivered beam used effectively for all experiments run at the facility. HRIBF achieved 77%, 3% short of the goal, as a result of an operational emergency that occurred near the end of FY 2008.

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[a] Measure established in FY 2009

FY 2010–2015	T: ≥ 80% A: TBD

Annual Performance Measure: Achieve at least 80% of the integrated delivered beam used effectively for experimental research in each of Halls A, B and C at the Continuous Electron Beam Accelerator Facility (CEBAF) measured as a percentage of the scheduled delivered beam considered effective for each Hall. The values from each Hall will be averaged for the end of year result starting in FY 2010.[a]

FY 2009	T: ≥ 80% A: Goal not met. Halls A and B met their goals for the year by achieving 95.9% and 86.6% effective use of their planned integrated delivered beam, respectively. However, because Hall C only achieved 67.4%, thus failing to meet its goal of 80%, the overall goal was "not met." Hall C performance was impacted by the failure of a target provided by outside collaborators that required significant time to repair and a second commissioning period.
FY 2010–2015	T: ≥ 80% A: TBD

Annual Performance Measure: Achieve at least 80% of the projected integrated heavy-ion collision luminosity sampled by each of the PHENIX and STAR experiments at the Relativistic Heavy Ion Collider, where the projected values take into account anticipated collider performance and detector data-taking efficiencies.[a]

FY 2009	T: N/A, Heavy-Ion collision experiments were not planned for FY 2009. A:
FY 2010–2015	T: ≥ 80% A: TBD

Annual Performance Measure: Achieve at least 80% of the projected integrated proton-proton collision luminosity for each of the PHENIX and STAR experiments at the Relativistic Heavy Ion Collider, where the projected values take into account anticipated collider performance and detector data-taking efficiencies.[a]

FY 2009	T: ≥ 80% A: Goal not met. PHENIX met the goal by achieving 90.5% of sampled integrated proton-proton collision luminosity, while STAR achieved only 65.4%. The STAR detector's low number is due to the fact that RHIC did not achieve its projected integrated luminosity for 200 GeV running. Both detectors were impacted, but only STAR failed to make the 80% goal. The facility was not able to achieve projected increases in the luminosity at 200 GeV that it had achieved in previous years. Beam studies indicated that the 200 GeV luminosity is at a maximum for the present machine configuration.

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[a] Measure established in FY 2009

FY 2010–2015	T: Proton-proton collision experiments are not planned for FY 2010. A: N/A

Annual Performance Measure: Achieve at least 80% average operation time of the scientific user facilities as a percentage of the total scheduled annual operating time.

FY 2006	T: 80% of scheduled operating time A: Goal met
FY 2007	T: 80% of scheduled operating time A: Goal met
FY 2008	T: 80% of scheduled operating time A: Goal met
FY 2009	T: 80% of scheduled operating time A: Goal met
FY 2010–2015	T: 80% of scheduled operating time A: TBD

Annual Performance Measure: Achieve within 10% for both the cost-weighted mean percentage variance from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects.

FY 2006	T: N/A, no major construction project/MIE tracked this fiscal year. A:
FY 2007	T: N/A, no major construction project/MIE tracked this fiscal year. A:
FY 2008	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2009	T: Cost and schedule variance are both less than 10% A: Goal met
FY 2010–2015	T: Cost and schedule variance are both less than 10% A: TBD

Medium Energy Nuclear Physics
Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Medium Energy Nuclear Physics			
Research			
University Research	18,678	19,674	20,796
National Laboratory Research	16,864	18,085	18,590
Other Research[a]	937	7,309	6,979
Total, Research	36,479	45,068	46,365
Operations			
TJNAF Operations	80,394	82,522	83,245
Total, Medium Energy Nuclear Physics	116,873	127,590	129,610

Description

The Medium Energy Nuclear Physics subprogram focuses primarily on questions having to do with Quantum Chromodynamics (QCD) and the behavior of quarks inside protons and neutrons, although it touches on all three scientific frontiers. Specific questions that are being addressed include: What is the internal landscape of the nucleons? What does QCD predict for the properties of strongly interacting matter? What governs the transition of quarks and gluons into pions and nucleons? What is the role of gluons and gluon self-interactions in nucleons and nuclei? One major goal, for example, is to achieve an experimental description of the substructure of the proton and the neutron. In pursuing that goal the Medium Energy subprogram supports different experimental approaches that seek to determine such things as: the distribution of up, down, and strange quarks in the nucleons; the roles of the gluons that bind the quarks; the role of the "sea" of virtual quarks and gluons, which makes a significant contribution to the properties of protons and neutrons; the effects of the quark and gluon spins within the nucleon; and the effect of the nuclear environment on the quarks and gluons. The subprogram also measures the excited states of hadrons (composite particles made of quarks, including nucleons) in order to identify which properties of QCD determine the dynamic behavior of the quarks.

The subprogram also supports investigations into a few aspects of the second frontier, Nuclei and Nuclear astrophysics, such as the question: What is the nature of the nuclear force that binds protons and neutrons into stable nuclei? Finally, this subprogram examines certain aspects of the third area, Fundamental Symmetries and Nuclei, including the questions: Why is there now more visible matter than antimatter in the universe? What are the unseen forces that were present at the dawn of the universe, but disappeared from view as it evolved?

Funding for this subprogram supports both research and operations of the subprogram's primary research facility, CEBAF, while only research is supported at RHIC. Research support at both facilities includes the laboratory and university personnel needed to implement and run experiments and to conduct the data analysis necessary to publish results. Individual experiments are supported at the High Intensity Gamma Source (HIγS) at Triangle University Nuclear Laboratory, at Fermi National Accelerator Laboratory (Fermilab), and at several facilities in Europe. All these facilities produce beams of sufficient energy (that is, of small enough wavelength) to see details smaller than the size of a nucleon.

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[a] In FY 2009, $3,665,000 was transferred to the SBIR program and $1,246,000 was transferred to the STTR program. This activity includes $4,034,000 for SBIR and $1,334,000 for STTR in FY 2010 and $4,082,000 for SBIR and $1,354,000 for STTR in FY 2011.

Construction of the 12 GeV CEBAF Upgrade project is a priority. CEBAF operations are reduced from 5,110 to 4,090 hours, the maximum level of operations possible in FY 2011 due to a planned shutdown to accommodate installation of components for the 12 GeV CEBAF Upgrade project.

Selected FY 2009 Accomplishments

- A recent series of measurements from TJNAF show evidence for a possible new excited state of the proton, that if confirmed, would help resolve a major debate concerning whether the three quarks that make up the proton bind together symmetrically or not. Asymmetrical binding was postulated to explain the lack of a large number of excited states predicted by symmetrical binding. If the asymmetrical binding is correct, then this new state should not exist.
- TJNAF researchers are on track to complete one of their major scientific performance milestones to determine the charge and magnetic distributions in the proton and neutron. The data set is of sufficient precision and quantity to allow scientists to separate the contributions of the different flavors of quarks (up, down, and strange) that determine the properties of the proton and neutron. New data on the charge distribution of the neutron have been collected that probe the smallest distances inside the neutron to date.
- TJNAF achieved a top beam energy of 6.0 GeV during their FY 2009 run period. This was a goal of the accelerator cavity refurbishment program that began in FY 2006 to increase the beam energy from the nominal maximum of 5 GeV.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	**36,479**	**45,068**	**46,365**
▪ **University Research**	**18,678**	**19,674**	**20,796**

This activity supports about 160 scientists and 125 graduate students at 33 universities in 21 states and the District of Columbia studying QCD and the behavior of quarks inside protons and neutrons. The university scientists conduct experiments at CEBAF and RHIC and participate in the development and fabrication of advanced instrumentation for utilization at these facilities. These state-of-the-art detectors often have relevance to applications in medicine and homeland security. Included in this activity is support for the Massachusetts Institute of Technology's Research and Engineering (R&E) Center that has specialized infrastructure for fabrication of scientific instrumentation. The Center has unique expertise in the study of high current, polarized electron sources. The FY 2011 request starts to build a user community for the new experimental hall scientific program being constructed as part of the 12 GeV CEBAF Upgrade Project.

	FY 2009	FY 2010	FY 2011
▪ **National Laboratory Research**	**16,864**	**18,085**	**18,590**

This funding supports research groups at TJNAF, BNL, ANL, LBNL, and LANL that carry out research at CEBAF and RHIC. It also supports two experiments at Fermilab and nuclear research

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

using laser trapping technology at ANL. Funding decisions are influenced by the results of periodic peer reviews of the national laboratory research groups and their subsequent ranking in terms of performance level.

	FY 2009	FY 2010	FY 2011
• **TJNAF Research**	**6,150**	**6,200**	**6,695**

TJNAF staff research efforts include developing experiments, acquiring data, and performing data analysis in the three existing CEBAF experimental Halls. Funding is provided to develop a scientific group for the new experimental Hall D that is being constructed as part of the 12 GeV CEBAF Upgrade project. Scientists also are identifying the scientific opportunities and developing the scientific goals for next generation facilities. The remaining approximately 70 percent of support for experiments at CEBAF is under Experimental Support discussed below. Funding also supports an active visiting scientist program at the laboratory and bridge positions with regional universities, which is a cost-effective approach to augmenting scientific expertise at the laboratory and boosts educational opportunities in the southeast region of the Nation. Detectors developed for nuclear physics research supported at TJNAF have found applications in medical imaging instrumentation.

	FY 2009	FY 2010	FY 2011
• **Other National Laboratory Research**	**10,714**	**11,885**	**11,895**

Argonne National Laboratory scientists continue their primary research program at TJNAF and one experiment at Fermilab. Argonne scientists are leading an experiment at Fermilab to distinguish the different quark contributions to the structure of the proton. These measurements are also important to interpreting the RHIC proton spin measurements. ANL scientists are also using their unique laser atom-trapping technique to make a precision measurement of the atomic electric dipole moment that could shed light on the excess of matter over antimatter in the universe. This technology at ANL has found practical applications in geology and environmental fields, for example, in tracking ground water flows in Egypt.

Support is provided to the RHIC spin physics research groups at BNL, LBNL, and LANL, which have important roles and responsibilities in the RHIC program. These groups play lead roles in determining the spin structure of the proton by development and fabrication of advanced instrumentation, as well as data acquisition and analysis efforts.

At LANL, support is provided to allow scientists and collaborators to complete the Fermilab MiniBooNE anti-neutrino running and analysis. A present discrepancy between the anti-neutrino and neutrino data needs to be resolved with additional anti-neutrino running. If these results are confirmed, they could unveil new physics beyond the Standard Model. The results of these efforts will drive future research directions of this group.

Modest funding for capital equipment investments at these laboratories is provided in support of the above efforts.

	FY 2009	FY 2010	FY 2011
▪ **Other Research**	**937**	**7,309**	**6,979**
• **SBIR/STTR and Other**	**572**	**6,544**	**6,279**

In FY 2009, $3,665,000 was transferred to the Small Business Innovation Research (SBIR) program and $1,246,000 was transferred to the Small Business Technology Transfer (STTR) program. This activity includes $4,034,000 for SBIR and $1,334,000 for STTR in FY 2010 and

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

$4,082,000 for SBIR and $1,354,000 for STTR in FY 2011 as well as other established obligations that the Medium Energy Nuclear Physics subprogram must meet.

	FY 2009	FY 2010	FY 2011
• **Accelerator R&D Research**	**365**	**765**	**700**

The Medium Energy Accelerator R&D research at universities and laboratories will develop the knowledge, technologies, and trained scientists to design and build the next-generation NP accelerator facilities. These programmatic activities are of relevance to machines being developed by other domestic and international programs and can lead to technological advances that are relevant to a variety of applications. Allocation of these funds will be determined by peer review and competed amongst university and laboratory proposals.

	FY 2009	FY 2010	FY 2011
Operations	**80,394**	**82,522**	**83,245**
▪ **TJNAF Operations**	**80,394**	**82,522**	**83,245**

Funding supports CEBAF operations and experimental support for 4,090 hours and a 3-Hall operations schedule, a 20 percent decrease from estimated running in FY 2010. The run time is the maximum possible due to a planned several-month shutdown in FY 2011 as part of the 12 GeV CEBAF Upgrade project schedule. The savings realized from reduced operational costs, such as power, are offset by cost of living increases for accelerator staff and materials and supplies needed to operate and maintain the facility. CEBAF is a unique facility with unparalleled capabilities using polarized electron beams to study quark structure; there is no other facility in the world like it and its user community has a strong international component.

	FY 2009	FY 2010	FY 2011
• **TJNAF Accelerator Operations**	**51,335**	**51,755**	**52,675**

Support is provided for the accelerator physicists that operate the facility, operations, power costs, capital infrastructure investments, and accelerator improvements of the CEBAF accelerator complex, and to maintain efforts in developing advances in superconducting radiofrequency (SRF) technology. The core competency in SRF technology that is nurtured at this laboratory plays a crucial role in many DOE projects and facilities outside of nuclear physics and has broad applications in medicine and homeland security. For example, SRF research and development at TJNAF has led to techniques for detection of buried land mines using terahertz radiation and carbon nanotube and nano-structure manufacturing techniques for the manufacture of super-lightweight composites such as aircraft fuselages.

TJNAF also has a core competency in cryogenics and has developed award-winning techniques which have led to more cost-effective operations at TJNAF and several other Office of Science facilities. TJNAF has recently been approached by the national Canadian nuclear physics facility, known as TRIUMF, and CERN for implementation of its cryogenic techniques.

TJNAF accelerator physicists are also strongly engaged in educating the next generation of accelerator physicists, with seventeen graduate students integrated into research programs and eleven staff members with university affiliations. TJNAF has started a Center for Accelerator Science at Old Dominion University (ODU) where staff members teach courses at the Center and the laboratory jointly supports the ODU Director position.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

Investments in accelerator improvement projects are aimed at increasing the productivity, cost-effectiveness, and reliability of the facility. Capital equipment investment is targeted towards instrumentation needed to support the laboratory's core competencies in SRF and cryogenics.

	FY 2009	FY 2010	FY 2011
CEBAF Hours of Operation with Beam			
Achieved Operating Hours	5,117	N/A	N/A
Planned Operating Hours	4,965	5,110	4,090
Optimal Hours	5,980	5,980	5,980[a]
Percent of Optimal Hours	86%	85%	68%
Unscheduled Downtime	8.	N/A	N/A
Number of Users	1,350	1,390	1,430

- **TJNAF Experimental Support** **29,059** **30,767** **30,570**

  Experimental Support is provided for the scientific and technical staff, materials, and services for CEBAF experiments and to integrate assembly, modification, and disassembly of large and complex experiments. This includes the delivery or dismantling of cryogenic systems, electricity, water for cooling, radiation shielding, and special equipment. Capital equipment investments for experimental support at TJNAF is maintained relative to FY 2010 to provide scientific instrumentation for the major experiments, including data acquisition computing and supporting infrastructure (e.g., targets, mechanical structures, power supplies, gas systems, and cooling equipment). In FY 2011, TJNAF expects to run experiments distributed among all three halls that address compelling physics including a precision measurement of the weak charge of the proton to help constrain new physics beyond the Standard Model, an important experiment for the laboratory's search for missing excited states of the neutron, and experiments that will help develop the laboratory's research program using the 12 GeV CEBAF Upgrade.

  The FY 2011 funding supports efforts to implement high priority experiments before the completion of the current 6 GeV experimental program and prior to the 12 GeV CEBAF Upgrade project installation.

Total, Medium Energy Nuclear Physics **116,873** **127,590** **129,610**

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[a] While the optimal operations for CEBAF remains at 5,980 hours, the maximum number of hours the facility can operate in FY 2011 is 4,090 hours due to a planned shutdown for installation of 12 GeV components. The facility therefore operates at 100% of maximal hours.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
University Research	
The increase in FY 2011 funding maintains the FY 2010 level of research effort at universities and starts to build a user community for the new experimental Hall D being constructed as part of the 12 GeV CEBAF Upgrade Project.	+1,122
National Laboratory Research	
The increase maintains National Laboratory Research at roughly the FY 2010 level of effort and develops a scientific group for the new experimental Hall D that is being constructed as part of the 12 GeV CEBAF Upgrade project.	+505
Other Research	
• SBIR/STTR and Other decreases at levels required proportionate to research and development activities.	-265
• Accelerator R&D research funding is provided at approximately the FY 2010 level to allow the university and national laboratory community to continue to develop the technologies needed for next generation NP facilities.	-65
Total, Other Research	**-330**
Total, Research	**+1,297**
Operations	
TJNAF Operations	
• **TJNAF Accelerator Operations**	
FY 2011 funding operates CEBAF at the maximum allowable schedule, in consideration of planned shutdowns for 12 GeV CEBAF Upgrade project component installation. The requested funding will support completion of the highest priority experiments within the current 6 GeV program and maintain the staff and infrastructure at approximate constant effort.	+920
• **TJNAF Experimental Support**	
Funding is provided to maintain effort in FY 2011 at a level that supports implementation of the highest priority 6 GeV experiments.	-197
Total, Operations	**+723**
Total Funding Change, Medium Energy Nuclear Physics	**+2,020**

Heavy Ion Nuclear Physics
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Heavy Ion Nuclear Physics			
Research			
University Research	14,009	14,474	15,511
National Laboratory Research	26,640	27,308	26,530
Other Research[a]	0	6,998	7,042
Total, Research	40,649	48,780	49,083
Operations			
RHIC Operations	148,684	157,470	163,301
Other Operations	5,624	5,750	6,051
Total, Operations	154,308	163,220	169,352
Total, Heavy Ion Nuclear Physics	194,957	212,000	218,435

Description

The Heavy Ion Nuclear Physics subprogram focuses on studies of nuclear matter at extremely high densities and temperatures. A new program of research on hot nuclear matter began at the Relativistic Heavy Ion Collider (RHIC) at BNL in 2000 when the first collisions of counter-circulating gold nuclei were observed at beam energies ten times higher than those available at any other facility in the world. At RHIC, beams of gold nuclei are accelerated to close to the speed of light and then slammed head on into one another in order to create extremely high-energy collisions between pairs of gold nuclei. In the aftermath of these collisions researchers have seen signs of the same quark-gluon plasma that is believed to have existed shortly after the Big Bang. With careful measurements, scientists accumulate data that offer insights into those brief moments immediately following the creation of the universe and begin to understand how the protons, neutrons, and other bits of normal matter developed from that plasma.

The RHIC facility places heavy ion research at the energy frontier of nuclear physics. RHIC serves two large-scale international experiments called PHENIX and STAR. In these experiments, scientists are now trying to determine the physical characteristics of the recently discovered perfect liquid of quarks and gluons. A 10-fold enhancement in the heavy ion beam collision rate and detector upgrades are expected to be completed within the next 5 years. Accelerator R&D is being conducted at RHIC in a number of advanced areas including cooling of high-energy hadron beams; high intensity polarized electron sources; and high-energy, high-current energy recovery linear (ERL) accelerators. The RHIC facility is used by about 1,200 DOE-, NSF-, and foreign agency-supported researchers.

The Large Hadron Collider (LHC) at CERN offers opportunities for making new discoveries in relativistic heavy ion physics. The LHC will provide a 30-fold increase in center-of-mass energy over what is available now. U.S. scientists are preparing to conduct research using A Large Ion Collider Experiment (ALICE) and the Compact Muon Spectrometer (CMS). U.S. researchers are fabricating a large Electromagnetic Calorimeter (EMCal) detector to be installed in phases in the ALICE experiment over the next few years. First heavy ion beam operations at the LHC are expected to start in 2010.

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[a] In FY 2009, $5,296,000 was transferred to the SBIR program. This activity includes $5,662,000 for SBIR in FY 2010 and $5,673,000 for SBIR in FY 2011.

The RHIC and LHC research programs are directed primarily at answering the overarching questions that define the first frontier identified by the nuclear science community—Quantum Chromodynamics (QCD). The fundamental questions addressed include: What are the phases of strongly interacting matter, and what roles do they play in the cosmos? What governs the transition of quarks and gluons into pions and nucleons? What determines the key features of QCD, and what is their relation to the nature of gravity and spacetime?

The funding for this subprogram is increased in FY 2011 to operate RHIC near optimal levels and to maintain research efforts.

Selected FY 2009 Accomplishments

- Scientists continued work to determine the physical characteristics of the perfect liquid produced in the highly energetic nucleus-nucleus collisions at RHIC. The temperature is one of the most important of these characteristics because it is a measure of the average energy of the particles inside this liquid. Energetic photons (or light) emanating from this perfect liquid have been observed and are one indicator of temperature. Further, data analysis now suggests that the initial fluid temperature may correspond to an energy greater than 300 MeV which exceeds the critical temperature thought necessary for the formation of the quark-gluon plasma.
- The formation of the anti-hypertriton (a hypertriton is a hypernucleus which is a nucleus that contains at least one hyperon—an unstable particle with a mass greater than a neutron—in addition to nucleons) is a major new discovery at RHIC. This observation could provide important information about the interior structure of neutron stars and the development of the cosmos.
- In FY 2009, RHIC delivered high intensity beams of polarized protons. Polarized protons were successfully accelerated to 250 GeV and first collisions for physics measurements at this energy occurred for several weeks.
- Plans for luminosity improvements for heavy ion collisions by implementing bunched-beam stochastic cooling systems are in progress. Tests have validated modeling codes which predict luminosity enhancement is feasible. Recovery Act funding has accelerated plans for stochastic cooling systems which are expected to be available in each RHIC collider ring by 2012. Accelerator scientists expect the planned implementation of longitudinal and transverse stochastic cooling to both accelerator rings, together with a new 56 MHz storage radio frequency system, will provide a 10-fold increase in gold beam luminosity by 2012. With these technological advances, the previously envisioned RHIC II upgrade is no longer needed and has been canceled by the NP program, saving the federal government approximately $100,000,000.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	**40,649**	**48,780**	**49,083**
▪ **University Research**	**14,009**	**14,474**	**15,511**

Research support is provided for about 120 scientists and 100 graduate students at 30 universities in 19 states. Funding supports research efforts at RHIC and the continuation of a modest program at the

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

LHC with heavy ions. The university groups provide scientific personnel and graduate students needed for running the RHIC and LHC heavy ion experiments, data analysis and publishing RHIC results, and designing and fabricating the RHIC and LHC heavy ion detector upgrades. For example, university personnel led the effort in the fabrication of the STAR Time-of-Flight detector, an MIE which was completed on cost and schedule in FY 2009.

The FY 2011 request maintains research effort and supports increases targeted towards operations of recently completed scientific instrumentation.

	FY 2009	FY 2010	FY 2011
▪ **National Laboratory Research**	**26,640**	**27,308**	**26,530**

This funding supports research groups at BNL, LBNL, LANL, ORNL, and LLNL that carry out research primarily at RHIC and a modest program at the LHC that supports the high priority scientific goals for the field of heavy ion physics. These scientists provide essential personnel for designing, fabricating, and operating the RHIC detectors; analyzing RHIC data and publishing scientific results; conducting R&D of innovative detector designs; project management and fabrication of MIEs; and planning for future experiments. Also, BNL and LBNL provide substantial computing infrastructure for terabyte-scale data analysis and state-of-the-art facilities for detector and instrument development. Some of the new research topics that will be investigated at RHIC in the next several years include determining the speed of sound in the quark-gluon plasma and trying to discover the critical point in the QCD phase diagram. RHIC could revolutionize the quantitative understanding of the QCD phase diagram by discovering the QCD critical point. Funding decisions are influenced by the results of periodic peer reviews of the national laboratory research groups and their subsequent ranking in terms of performance level.

	FY 2009	FY 2010	FY 2011
• **BNL RHIC Research**	**9,602**	**9,032**	**10,797**

The FY 2011 budget request allows BNL scientists to continue to develop and implement new instrumentation, to provide maintenance and infrastructure support of the RHIC experiments, to effectively utilize the beam time for research, to train junior scientists, and to develop the computing infrastructure used by the scientific community. The PHENIX Silicon Vertex Tracker (VTX) MIE, a joint project with Japan, received its final funding increment under the Recovery Act and is on track for completion in FY 2010 on cost and schedule. It is a barrel of silicon pixel and strip detectors that will provide precision measurement of heavy quark production to study the thermalization process in the heavy ion collisions. The PHENIX Forward Vertex Detector (FVTX) MIE also received its final funding under the Recovery Act and is on track for completion in FY 2011 on cost and schedule. Important for both the heavy ion and spin programs, this detector will provide vertex tracking capabilities to PHENIX by adding two silicon endcaps. The STAR Heavy Flavor Tracker (HFT), a new MIE initiated in FY 2010, is an ultra-thin, high-precision tracking detector that will provide direct reconstruction of short-lived particles containing heavy quarks. Support for this initiative ramps up in FY 2011 in accordance with project plans and dominates the increase in this funding category relative to FY 2010. Funding supports the efforts of BNL scientists to identify the most compelling scientific opportunities for a possible future electron ion collider. Capital equipment funds are provided to meet the computing obligations of U.S. researchers involved in the LHC program.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
• **Other National Laboratory Research**	**17,038**	**18,276**	**15,733**

Researchers at LANL, LBNL, LLNL, and ORNL provide support for the RHIC and LHC experiments and develop new instrumentation. They also provide unique expertise and facilities for RHIC and LHC detector upgrades and analyses of data. For example, at LBNL, the large scale computational system, Parallel Distributed Systems Facility (PDSF), is a major resource used for the analysis of RHIC and LHC data, in alliance with the National Energy Research Scientific Computing Center (NERSC). At LLNL, computing resources are made available for the LHC data analysis. LBNL staff are leading the fabrication of the LHC Heavy Ion MIE, a joint project with France and Italy that adds a large Electromagnetic Calorimeter (EMCal) to the CERN ALICE heavy ion experiment to provide the capability to study energy loss in the quark-gluon plasma. Support for the EMCal ramps down in FY 2011 according to the planned profile, and is the cause for the decrease in funding in this category relative to FY 2010.

	FY 2009	FY 2010	FY 2011
▪ **Other Research**	**0**	**6,998**	**7,042**
• **SBIR and Other**	**0**	**5,728**	**5,742**

In FY 2009, $5,296,000 was transferred to the Small Business Innovative Research (SBIR) program. This activity includes $5,662,000 for SBIR in FY 2010 and $5,673,000 for SBIR in FY 2011 as well as other established obligations that the Heavy Ion Nuclear Physics subprogram must meet.

	FY 2009	FY 2010	FY 2011
• **Accelerator R&D Research**	**0**	**1,270**	**1,300**

The Heavy Ion Accelerator R&D research at universities and laboratories will develop the knowledge, technologies, and trained scientists to design and build the next-generation NP accelerator facilities. These programmatic activities are of relevance to machines being developed by other domestic and international programs and can lead to technological advances that are relevant to a variety of applications. Allocation of these funds will be determined by peer review and competed among university and laboratory proposals.

	FY 2009	FY 2010	FY 2011
Operations	**154,308**	**163,220**	**169,352**
▪ **RHIC Operations**	**148,684**	**157,470**	**163,301**

RHIC operations are supported for an estimated 3,720 hour operating schedule (91 percent utilization) in FY 2011, an increase of 370 hours over FY 2010 which effectively addresses high priority scientific opportunities and goals. In FY 2011, it is currently planned to conduct the first search at RHIC for discovering the critical point in the QCD phase diagram. This would be the first such measurement of its kind and is important because it would identify when certain phase transitions occur in a medium, such as a region in the interior of a neutron star, or inside the hot and dense fireball created by a heavy ion collision.

The Electron Beam Ion Source (EBIS) construction project will be completed in FY 2010 and its implementation, along with detector upgrades, will allow the RHIC program to make incisive measurements leading to more definitive conclusions on the discovery of strongly interacting quark gluon matter and to establish whether other phenomena, such as a color glass condensate or chiral symmetry restoration exist in nature. EBIS will also lead to more cost-effective operations of the facility as it replaces the aging Tandems as part of the RHIC injector. DOE and NASA partnered on the construction of EBIS, and this project will also provide new capabilities to the NASA Space Radiation Program.

- **RHIC Accelerator Operations** **115,560** **121,935** **126,337**

  Support is provided for the operations, power costs, capital infrastructure investments, and accelerator improvement projects of the RHIC accelerator complex. This includes EBIS, the Booster, and AGS accelerators that together serve as the injector for RHIC. Measurements of rare particles will require higher integrated beam luminosity and modest support is provided for R&D of electron beam cooling and other luminosity enhancement technologies. Funding is also provided to reduce the backlog of infrastructure items which most impede the cost-effective and efficient operations of the facility. Operations of RHIC also support parallel (and cost-effective) operations of the NASA Space Radiation Program, for the study of space radiation effects applicable to human space flight, and the Brookhaven Linac Isotope Production Facility (BLIP), for the production of research and commercial isotopes needed by the Nation. Funding is increased to operate RHIC close to optimal levels. A slight decrease in accelerator improvement funding in FY 2011 is made possible by the advance of funding under the Recovery Act in FY 2009.

  BNL has nurtured core competencies in accelerator physics techniques, which have had applications in industry, medicine, homeland security, and other scientific projects outside of NP. The RHIC accelerator physicists have been leading the effort to address technical feasibility issues which are of relevance to a possible future collider, including beam cooling techniques and energy recovery linacs. RHIC accelerator physicists also play an important role in the education of next generation accelerator physicists, with support of graduate and post-doctoral students. The laboratory supports the Center for Accelerator Science and Education (CASE) in partnership with Stony Brook University. CASE takes advantage of the collaboration with BNL, providing opportunities for students to learn on the state-of-the-art accelerators at BNL and by having BNL staff teach courses and advise students.

	FY 2009	FY 2010	FY 2011
RHIC Hours of Operation with Beam			
Achieved Operating Hours	3,153	N/A	N/A
Planned Operating Hours	2,915	3,350	3,720
Optimal Hours	4,100	4,100	4,100
Percent of Optimal Hours	77%	82%	91%
Unscheduled Downtime	19.7%	N/A	N/A
Number of Users	1,200	1,200	1,200

- **RHIC Experimental Support** **33,124** **35,535** **36,964**

  Support is provided for the operation, maintenance, improvement, and enhancement of the RHIC experimental complex, including the STAR and PHENIX detectors, experimental halls, computing center, and support for users. The STAR and PHENIX detectors provide complementary measurements, with some overlap in order to cross-calibrate the measurements.

(dollars in thousands)

Instrumentation advances by this community have led to practical applications. For example, technical developments from the RHIC detectors, especially PHENIX, have recently led to the development of a positron emission tomography scanner to image the brain of an awake animal. Capital equipment funding is provided to maintain computing capabilities at the RHIC Computing Facility.

	FY 2009	FY 2010	FY 2011
▪ **Other Operations**	**5,624**	**5,750**	**6,051**

The Nuclear Physics program provides funding to BNL for minor new fabrications, needed laboratory equipment (including general purpose equipment), and other expenses. Funding of this type is essential for maintaining the productivity and usefulness of DOE-owned facilities and for meeting its requirement for safe and reliable facilities operation.

	FY 2009	FY 2010	FY 2011
Total, Heavy Ion Nuclear Physics	**194,957**	**212,000**	**218,435**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
▪ **University Research**	
The increase for University Research grants in FY 2011 maintainseffort for data collection with STAR and PHENIX, supports research at the LHC heavy ion program, and provides for operations of recently completed scientific instrumentation.	+1,037
▪ **National Laboratory Research**	
• BNL RHIC Research is increased relative to FY 2010 largely due to an increase for the fabrication of the STAR HFT MIE according to the planned funding profile, as well as supporting research with the STAR and PHENIX detectors.	+1,765
• Other National Laboratory Research decreases in FY 2011 as funding ramps down for the final year of funding to complete the fabrication of the LHC Heavy Ion MIE according to the planned profile.	-2,543
Total, National Laboratory Research	**-778**
▪ **Other Research**	
• SBIR and Other increases at levels required proportionate to R&D activities.	+14

	FY 2011 vs. FY 2010 ($000)
• Accelerator R&D research is increased in FY 2011 to enable the university and national laboratory community to continue to develop the technologies needed for next-generation NP facilities.	+30
Total, Other Research	**+44**
Total, Research	**+303**
Operations	
▪ **RHIC Operations**	
• RHIC Accelerator Operations increases in FY 2011 to maintain operations 370 hours above FY 2010 levels.	+4,402
• RHIC Experimental Support increases in FY 2011 to maintain efforts associated with the implementation of experimental and computing capabilities and infrastructure.	+1,429
Total, RHIC Operations	**+5,831**
▪ **Other Operations**	
Funding increases to maintain laboratory general purpose equipment.	+301
Total, Operations	**+6,132**
Total Funding Change, Heavy Ion Nuclear Physics	**+6,435**

Low Energy Nuclear Physics

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Low Energy Nuclear Physics			
Research			
University Research	20,601	22,186	22,582
National Laboratory Research	31,447	41,448	41,139
Other Research[a]	960	2,011	1,952
Total, Research	53,008	65,645	65,673
Operations	34,872	36,991	37,793
Facility for Rare Isotope Beams	7,000	12,000	10,000
Total, Low Energy Nuclear Physics	94,880	114,636	113,466

Description

The research effort supported by the Low Energy Nuclear Physics subprogram aims primarily at answering the overarching questions associated with the second and third frontiers identified by NSAC. Questions associated with the second frontier, Nuclei and Nuclear Astrophysics, include: What is the nature of the nuclear force that binds protons and neutrons into stable nuclei and rare isotopes? What is the origin of simple patterns in complex nuclei? What is the nature of neutron stars and dense nuclear matter? What is the origin of the elements in the cosmos? What are the nuclear reactions that drive stars and stellar explosions? Major goals of this subprogram are to develop a comprehensive description of nuclei across the entire nuclear chart, to utilize rare isotope beams to reveal new nuclear phenomena and structures unlike those gleaned from studies using stable nuclei, and to measure the cross sections of nuclear reactions that power stars and spectacular stellar explosions and are responsible for the synthesis of the elements.

The subprogram also investigates aspects of the third frontier, Fundamental Symmetries and Interactions, using neutrinos and neutrons as primary probes. Questions addressed in this frontier include: What is the nature of the neutrinos, what are their masses, and how have they shaped the evolution of the universe? Why is there now more visible matter than antimatter in the universe? What are the unseen forces that were present at the dawn of the universe but disappeared from view as the universe evolved? Neutrinos are now known to have small but non-zero masses. The subprogram seeks to measure or set a limit on the neutrino mass and to determine if the neutrino is its own antiparticle (a Majorana particle). These neutrino properties are believed to play a role in the evolution of the cosmos. Beams of cold and ultracold neutrons will be used for precision measurements of neutron lifetime and beta-decay parameters and to investigate the dominance of matter over antimatter in the universe in order to answer fundamental questions in nuclear and particle physics, astrophysics, and cosmology. Funding supports both research and operations of the subprogram's two national user facilities, HRIBF and ATLAS, which serve an international community of approximately 700 users. These two facilities

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[a] In FY 2009, $1,426,000 was transferred to the SBIR program. This activity includes $1,426,000 for SBIR in FY 2010 and $1,528,000 for SBIR in FY 2011.

provide beams for nuclear structure and astrophysics studies and a strong training ground for the next generation Facility for Rare Isotope Beams (FRIB), which will be constructed at MSU. Both HRIBF and ATLAS possess unique capabilities in an international context and have cutting edge instrumentation. Research at these facilities are coordinated and optimized to achieve the high priority scientific goals for this field. Fabrication of the Gamma Ray Energy Tracking In-Beam Nuclear Array (GRETINA) MIE is on track for completion in FY 2011. GRETINA, a segmented germanium detector array with unparalleled position and energy resolution for nuclear structure studies with fast nuclear beams, will rotate amongst the domestic low-energy facilities thereby increasing scientific productivity. Support continues in FY 2011 for efforts in implementing the Rare Isotope Beam Science Initiatives, enabling U.S. researchers to participate in forefront rare isotope beam facilities with unique capabilities around the world. A peer review process, started in August 2009, recently identified eleven initiatives that will be pursued, varying in cost and complexity. These are now undergoing individual peer review; NP will break out and separately describe the selected Major Items of Equipment in future budget narratives. These efforts encourage cooperation and communication on a global level in this quickly evolving field of science. The NP program also supports the LBNL 88-Inch Cyclotron for a small in-house nuclear physics and chemistry research program, while the National Reconnaissance Office (NRO) and U.S. Air Force (USAF) provide support towards improvements in radiation hardness of electronic circuit components against damage caused by cosmic rays. In addition, the subprogram supports accelerator operations at Texas A&M University (TAMU), at the Triangle Universities Nuclear Laboratory (TUNL) at Duke University, and at Yale University for studies in nuclear structure and nuclear astrophysics. At the University of Washington, the subprogram supports infrastructure to develop scientific instrumentation projects and to provide technical and engineering educational opportunities. These university Centers of Excellence each support 15–25 graduate students at different stages of their education.

Progress in both nuclear structure and nuclear astrophysics studies depends increasingly upon the availability of rare isotope beams. While ATLAS and HRIBF have capabilities for these studies, a facility with next-generation capabilities for short-lived radioactive beams is needed to maintain a leadership role. A study by the National Academies concluded that such a facility was a priority for the U.S. nuclear physics program, and the NSAC Long Range Plan recommended its construction. In FY 2008, NP announced an open solicitation to universities and laboratories, inviting proposals for FRIB. Following peer review of the submitted proposals, the DOE selected Michigan State University (MSU) as the host institution to establish FRIB. This project is supported with operating funding through a Cooperative Agreement with MSU and will follow the management principles of DOE O 413.3A. Supporting information on the project is provided at the end of this budget narrative. While not a DOE capital asset (the facility will be owned by the university) it will be operated as a DOE national user facility upon completion. In FY 2011, engineering and design activities begin on FRIB.

In the area of neutrino physics, U.S. researchers are involved in several important efforts focused primarily on neutrino mass and whether the neutrino is its own anti-particle. The U.S. continues to participate in the fabrication of the Italian-lead Cryogenic Underground Observatory for Rare Events (CUORE) experiment at the Gran Sasso Laboratory to search for evidence that the neutrino is its own antiparticle and measure or set a limit on the effective mass of the neutrino using the neutrinoless double beta decay (DBD) mechanism. Efforts also continue in FY 2011 on the Majorana Demonstrator R&D effort to determine technical feasibility of using high purity, enriched germanium to explore the nature of the neutrino via DBD. Projects that study DBD with extreme sensitivity such as these will address two fundamental properties of the neutrino, its mass and its particle-antiparticle nature, that are important for understanding the matter-antimatter asymmetry in the universe and the evolution of the cosmos. U.S. university scientists are also participating in the fabrication of the German-lead Karlsruhe Tritium Neutrino (KATRIN) experiment to determine the mass of the electron neutrino by measuring the beta decay spectrum of tritium. Finally, U.S. researchers at the Kamioka Large Anti-Neutrino Detector (KamLAND) experiment in Japan are continuing a modest effort to study the properties of anti-neutrinos produced by nuclear power reactors. The experiment is entering a new phase to measure lower-energy solar neutrinos following a Japanese-funded upgrade of the detector.

The Low Energy subprogram supports studies of fundamental interactions and symmetries using neutrons or nuclei. Sensitive experiments are being prepared to be mounted at the Fundamental Neutron Physics Beamline (FNPB), which is on track for completion in FY 2010 on cost and schedule at the SNS. These include the neutron Electric Dipole Moment Experiment MIE currently being fabricated at Oak Ridge National Laboratory, which could shed light on why the universe is composed mostly of matter when the Big Bang Theory of cosmology suggests that the universe should contain equal amounts of matter and anti-matter.

Finally, it is within the Low Energy subprogram, as well as the Theory subprogram, that the Applications for Nuclear Science and Technology initiative is supported. This effort was started in FY 2009 and was augmented with Recovery Act funds. Community response to this initiative was extremely positive with over 200 proposals that were peer reviewed to identify the most compelling opportunities; 14 projects were selected for funding under the Low Energy program. This initiative supports basic nuclear physics research that addresses high priority scientific goals and has practical applications to other fields, such as medicine, next-generation nuclear reactors, and homeland security.

The Low Energy subprogram is the broadest within the NP portfolio, supporting research activities aligned with diverse scientific thrusts. It also currently supports the most instrumentation projects, as well as the Majorana Demonstrator R&D effort and the Cooperative Agreement to construct FRIB; most of these initiatives are international in nature and project profiles are optimized to take advantage of international commitments.

Selected FY 2009 Accomplishments

- A new upper limit on the permanent electric dipole moment of atomic mercury has been reported by University of Washington scientists. The electric dipole moment is generated by interactions that violate time reversal symmetry (i.e., physical laws remain unchanged when time is reversed). The result obtained for mercury-199 is the most sensitive test of time reversal symmetry violation in ordinary matter achieved to date. Measuring time reversal symmetry is important because it constrains possible extensions of the Standard Model of particles and fundamental interactions.
- New precise mass measurements of 55 neutron-rich nuclei have been carried out at the ATLAS facility with the Canadian Penning Trap. The data indicate that nuclei with increasingly higher neutron excess are not as tightly bound as previously thought. This observation affects nucleosynthesis models of the astrophysical *r*-process, the process responsible for the creation of 50 percent of the elements in the Universe.
- The process of beta-delayed neutron emission (b_n) from fission products created in nuclear reactors contributes to the total number of neutrons inducing fission in nuclear fuels. The b_n also shapes the final distribution of nuclei remaining after a supernovae explosion. Scientists at HRIBF have developed unique methods for separating the rare neutron-rich fission products of interest and measuring their decays. Studies of these pure isotopic samples indicate beta-delayed neutron decay rates that are two to five times higher than previously reported. These findings have important

implications for design of next-generation nuclear fuels and modeling of astrophysical nucleosynthesis processes.

- Successes in the synthesis of the heaviest elements with atomic numbers Z=114 to 118 have been reported by Russian scientists using "hot" fusion reactions. These important results, however, had not been confirmed independently. Recently, scientists using beams and experimental facilities at the 88-Inch Cyclotron at LBNL succeeded in reproducing the Russian results for the synthesis of Element 114. This confirmation allows the field of chemistry to claim the discovery of Element 114 and validates the utility of "hot" fusion as an important tool for synthesis of heavier elements.
- Large amounts of radioactive aluminum-26 (^{26}Al) have been detected in the galaxy by satellite observatories, but the source is still unknown. Researchers at ORNL have used intense beams of ^{26}Al at HRIBF to probe important energy levels that elucidate production and subsequent destruction of this nucleus in some massive and exploding stars. These results are being incorporated into models that aim at improved understanding of ^{26}Al production in the galaxy.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Research	**53,008**	**65,645**	**65,673**
▪ **University Research**	**20,601**	**22,186**	**22,582**

Research aimed at addressing high priority scientific goals is supported for about 126 scientists and 98 graduate students at 35 universities; university research is supported in FY 2011 at approximately a constant level of effort relative to FY 2010. About two-thirds of the supported university scientists conduct nuclear structure and astrophysics research using specialized instrumentation at the ATLAS and HRIBF national user facilities.

Accelerator operations are supported for primarily in-house research programs at the facilities at Duke University, TAMU, and Yale University. These Centers of Excellence have well-defined and unique physics programs, providing photons, neutrons, light ion beams, or heavy ion beams, specialized instrumentation, and opportunities for long-term measurements that complement the capabilities of the national laboratory user facilities; they also provide excellent training opportunities to junior scientists and engineers.

University scientists are supported to play key roles in the development of experiments using cold neutrons at the SNS FNPB—an experimental program which is being launched in FY 2011. The FY 2011 request also includes support for the international KATRIN project which is led by a university group.

▪ **National Laboratory Research**	**31,447**	**41,448**	**41,139**

Support is provided for the research programs at six national laboratories (ANL, BNL, LBNL, LANL, LLNL, and ORNL). These scientists continue to develop and implement new instrumentation, to provide maintenance and infrastructure support of the ATLAS and HRIBF, to effectively utilize beam time for research, to train junior scientists, to develop and utilize non-accelerator experiments, and to support the development and fabrication of FRIB. Funding decisions are influenced by the results of periodic peer reviews of the national laboratory research groups and their subsequent ranking in terms of performance level.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
• **National Laboratory User Facility Research**	**11,326**	**8,768**	**9,840**

Questions fundamental to the understanding of stellar nucleosynthesis—how the elements are manufactured in stars—requires accelerators with low energy capabilities. In fact, because many nuclear reactions that take place in stars are at very low energies, an accelerator capable of producing stable low energy beams is a requirement. Funding is provided for ANL researchers for nuclear structure studies using stable and selected radioactive beams from ATLAS coupled to specialized instrumentation. Modest capital equipment investments support the fabrication and implementation of small-scale detectors at the facility. The most recent addition to the unique instrumentation at ATLAS is the HELical Orbit Spectrometer (HELIOS), a novel superconducting solenoidal spectrometer that probes the structure of exotic nuclei.

Because stars generate heavier elements from lighter ones in a process that takes place in the cores of stars or through stellar explosions, many of the intermediate nuclei that are produced are short-lived and very unstable. To study them requires accelerators capable of producing beams composed of radioactive ions. ORNL researchers use radioactive beams from the HRIBF and specialized spectrometers to study the nuclear structure of nuclei far from stability. Nuclei far from stability are thought to play a decisive role in those astrophysical processes that build up heavier elements from lighter nuclei, e.g., in supernovae, and thus knowledge about such exotic nuclei can help us understand our own origin. The fabrication and implementation of small-scale detectors at HRIBF are supported with modest capital equipment investments. For example, the recently completed Low-energy Radioactive Ion Beam Spectroscopy Station (LeRIBSS) enables exploitation of the most neutron rich beams at HRIBF to study fission products such as those in nuclear reactors. Increased funding in FY 2011 maintains efforts at ATLAS and HRIBF.

• **Other National Laboratory Research**	**20,121**	**32,680**	**31,299**

Scientists at BNL, LBNL, LLNL, LANL, and ORNL play lead roles in several high-priority accelerator- and non-accelerator-based projects (nEDM, CUORE, RIB Science Initiatives, GRETINA, FNPB, and KamLAND). Both nEDM and CUORE are joint DOE/NSF-supported projects, but managed by DOE-supported scientists. In addition, DOE-supported scientists have the lead role in the R&D to demonstrate a proof of principle for a neutrino-less double beta decay experiment with germanium, the Majorana Demonstrator. The total cost of the Majorana R&D effort over four years is approximately $20,000,000. Researchers are also supported to develop and implement neutron science experiments at the newly completed fundamental neutron physics beamline at the Spallation Neutron Source and to contribute to FRIB project engineering and design efforts.

Research efforts relevant to Applications of Nuclear Science and Technology are decreased by $980,000 in FY 2011 relative to FY 2010 as a result of funding a number of multi-year initiatives under the Recovery Act. This initiative is competed among university and laboratory researchers and supports nuclear science research that is inherently relevant to a broad range of applications. A number of instrumentation MIEs are supported within this activity; the project funding profiles tend to drive the overall funding requests of this subprogram. Capital equipment funding is increased in FY 2010 to support the ongoing instrumentation projects according to planned profiles and to initiate a new MIE. In FY 2011, funding for capital equipment decreases as the result of planned funding profiles.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

- The GRETINA MIE, which is scheduled for completion in FY 2011, is especially important for the study of the nuclear structure of rare isotopes produced in reactions with fast fragmentation beams. FY 2010 is the final year of funding. GRETINA will be shared amongst low-energy facilities in the United States (including an NSF facility) to cost-effectively boost scientific productivity.
- Support is provided to ORNL to continue to play a leadership role in the development of the scientific and experimental program with neutrons at the FNPB, a beamline at the SNS. The FNPB, which will be completed in FY 2010, will deliver cold and ultra-cold neutrons at the highest intensities in the world for studying the fundamental properties of the neutron, leading to a refined characterization of the weak force.
- In FY 2011, funding continues for the fabrication of the Electric Dipole Moment of the neutron (nEDM) MIE, a high-risk, high-potential discovery experiment at the FNPB. The nEDM experiment is a joint DOE/NSF experiment to measure a non-zero electric dipole moment of the neutron, which will significantly constrain extensions of the Standard Model. Fabrication, scheduled to start in FY 2010, will be initiated once the project completes high-priority R&D, and is baselined and has CD-2 approval.
- In FY 2011, funding ramps down to continue fabrication of the international CUORE experiment to search for neutrino-less double beta decay (DBD) of tellurium-130 isotope. This is a joint DOE/NSF project.
- In FY 2011, funding increases to continue Rare Isotope Beam Science Initiatives to support forefront scientific instrumentation opportunities at rare isotope beam facilities around the world. A merit peer review was held in August 2009 to identify the most compelling initiatives to fabricate and to guide the optimum balance of funding between R&D activities and fabrication activities in FY 2010 and FY 2011. The selected initiatives are undergoing project-specific peer review, and selected Major Items of Equipment will be broken out and separately described in future budget narratives. No fabrication activities on the MIEs will be supported prior to project baseline or CD-2 approval.

	FY 2009	FY 2010	FY 2011
▪ **Other Research**	**960**	**2,011**	**1,952**

In FY 2009, $1,426,000 was transferred to the SBIR program. This activity includes $1,426,000 for SBIR in FY 2010, and $1,528,000 for SBIR in FY 2011. Funding is also provided for other established obligations including the Lawrence and Fermi Awards, which provide annual monetary awards to honorees selected by DOE for outstanding contributions to science.

	FY 2009	FY 2010	FY 2011
Operations	**34,872**	**36,991**	**37,793**
▪ **ATLAS Operations**	**15,180**	**16,093**	**16,196**

The ATLAS Facility is the premiere stable beam facility in the world. ATLAS accelerator operations and experimental support provide for 5,900 beam hours of operation and continued cost-effective 7 day-a-week operations in FY 2011, the same as FY 2010. The slight increase in funding in FY 2011 maintains level of effort support for scientific and technical personnel. The Californium Rare Ion Breeder Upgrade (CARIBU) accelerator improvement project is completed in FY 2010, and will enhance the radioactive beam capabilities and productivity of ATLAS. Accelerator

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

improvement projects in FY 2011 are focused on increasing the reliability and efficiency of operations. Modest capital equipment funding is provided for helium compressors and cryogenics upgrades to improve operations. The ATLAS facility nurtures a core competency in accelerator expertise with superconducting radio frequency cavities for heavy ions that is relevant to the next generation of high-performance proton and heavy-ion linacs, and is important to the Office of Science mission and international stable and radioactive ion beam facilities. ANL accelerator physicists and scientists are working closely with MSU researchers in the development and fabrication of components for FRIB.

	FY 2009	FY 2010	FY 2011
ATLAS Hours of Operation with Beam			
Achieved Operating Hours	5,448	N/A	N/A
Planned Operating Hours	5,200	5,900	5,900
Optimal Hours	6,600	6,600	6,600
Percent of Optimal Hours	83%	89%	89%
Unscheduled Downtime	4.1%	N/A	N/A
Number of Users	360	410	410

- **HRIBF Operations** **15,860** **16,645** **17,174**

HRIBF is the only facility in the U.S. dedicated solely to the production of radioactive beams by the Isotope Separator On-Line (ISOL) technique, which can produce extremely intense beams of rare isotopes, and is the only one that reaccelerates medium mass nuclei to the Coulomb barrier. Accelerator physicists and scientists at this facility have developed core competencies in high power target design and ISOL ion beam production techniques that are recognized in an international context. HRIBF accelerator operations and experimental support provide for 5,200 beam hours of operation and the transition from 5 day to the more cost effective 7 day-a-week operations. The facility begins to commission a second source and transport beamline (IRIS2) for radioactive ions in FY 2010, which will increase operations efficiency and reliability. Accelerator improvement projects target the elimination of single-point failures and increased operations reliability. Capital equipment funding is provided for items such as accelerator power supplies and remote handling systems to enhance performance and increase scientific productivity.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

	FY 2009	FY 2010	FY 2011
HRIBF Hours of Operation with Beam			
Achieved Operating Hours	4,653	N/A	N/A
Planned Operating Hours	3,600	5,200	5,200
Optimal Hours	6,100	6,100	6,100
Percent of Optimal Hours	76%	85%	85%
Unscheduled Downtime	14.7%	N/A	N/A
Number of Users	260	260	260

- **Other Operations** — **3,832** — **4,253** — **4,423**

  The NRO and USAF will continue to jointly provide support for the 88-Inch Cyclotron for approximately 2,000 hours for their electronics testing program, and NP continues support in FY 2011 for approximately 3,000 hours for the in-house nuclear physics research program at LBNL. Funding is also provided for maintenance of the Oak Ridge Electron Accelerator (ORELA) which is used for criticality measurements supported by DOE/NNSA.

Facility for Rare Isotope Beams — **7,000** — **12,000** — **10,000**

Funds are requested in FY 2011 to begin engineering and design efforts aimed at developing FRIB. MSU is undertaking a comprehensive R&D plan for FRIB, utilizing core competencies developed at the NP-supported national laboratory groups. This facility will enable world-leading research opportunities in nuclear structure, nuclear astrophysics, and fundamental studies, and complement other rare isotope beam research programs at facilities elsewhere in the world (for additional details, see the Supporting Information section). The FY 2011 funding supports the project profile as agreed upon between MSU and DOE in the Cooperative Agreement.

Total, Low Energy Nuclear Physics — **94,880** — **114,636** — **113,466**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
University Research	
FY 2011 funding increases to maintain support for university researchers.	+396
National Laboratory Research	

- National Laboratory User Facility Research funding maintains personnel at levels needed to support the highest priority research efforts and implementation of

	FY 2011 vs. FY 2010 ($000)
scientific instrumentation at the ATLAS national user facility and increases staff at HRIBF.	+1,072
• Other National Laboratory Research funding supports a number of MIEs according to their planned project profile, maintaining cost and schedule baselines and meeting international commitments. In FY 2011, funding in total for all of the Low Energy Nuclear Physics MIEs decreases by $3,504,000. Funding for research relevant to Applications of Nuclear Science and Technology decreases by $980,000 relative to FY 2010 as a result of funding a number of multi-year proposals with FY 2009 funding and Recovery Act funding. Offsetting these decreases are increases for the proof of principle Majorana Demonstrator R&D project which begins to ramp up in FY 2011 (+$1,700,000), the development of experiments for the new neutron science program at the FNPB (+$1,000,000), and a modest increase to maintain laboratory research groups (+$403,000).	-1,381
Total, National Laboratory Research	**-309**
▪ **Other Research**	
SBIR and other funded at levels required proportionate to R&D activities.	-59
Total, Research	**+28**
Operations	
▪ ATLAS Operations reflects an increase to maintain staff and effectively operate this national user facility, which is partially offset by a decrease in accelerator improvement project funding as a result of completion of the CARIBU accelerator project in FY 2010.	+103
▪ The increase in HRIBF Operations addresses staffing requirements to effectively operate and maintain this national user facility.	+529
▪ Other Operations increases to provide needed funding for maintenance of operations at the 88-Inch Cyclotron and ORELA at approximately a constant level of effort.	+170
Total, Operations	**+802**
Facility for Rare Isotope Beams	
▪ Funding for the Facility for Rare Isotope Beams is requested to begin engineering and design work; the decrease is consistent with the planned profile in the Cooperative Agreement signed with MSU in June 2009.	-2,000
Total Funding Change, Low Energy Nuclear Physics	**-1,170**

Nuclear Theory

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Nuclear Theory			
Theory Research			
University Research	14,551	15,060	15,753
National Laboratory Research	13,482	16,089	17,587
Scientific Discovery through Advanced Computing (SciDAC)	2,679	2,773	2,870
Total, Theory Research	30,712	33,922	36,210
Nuclear Data Activities	7,064	7,652	8,499
Total, Nuclear Theory	37,776	41,574	44,709

Description

The Nuclear Theory subprogram supports theoretical research at universities and DOE national laboratories with the goal of improving fundamental understanding of nuclear physics, interpreting the results of experiments carried out under the auspices of the experimental nuclear physics program, and identifying and exploring important new areas of research.

This subprogram addresses all three of nuclear physics' scientific frontiers. A major theme of this subprogram is an understanding of the mechanisms and effects of quark confinement and de-confinement. A quantitative description of these phenomena starting from the fundamental theory of QCD remains one of this subprogram's great intellectual challenges. New theoretical and computational tools are being developed to describe nuclear many-body phenomena, which will likely have important applications in condensed matter physics and in other areas of the physical sciences. Another major research area is nuclear astrophysics, which includes efforts to understand the origins of the elements (as in supernovae) and the consequences that neutrino masses have for nuclear astrophysics and for the current theory of elementary particles and forces.

One area of nuclear theory that has a particularly pressing demand for large dedicated computational resources is that of lattice quantum chromodynamics (LQCD). LQCD calculations are critical for understanding many of the experimental results from RHIC and CEBAF that involve the strong interaction between quarks and gluons. This subprogram provides researchers with adequate access to powerful supercomputers for these studies, such as the high-performance computational facility at the National Energy Research Scientific Computing Center (NERSC) at LBNL, as well as specialized computers at other institutions. In a joint effort started in FY 2006, the Nuclear Theory subprogram and the High Energy Physics (HEP) Theory subprogram initiated the development of large-scale facilities to provide computing capabilities based on community cluster systems. By the end of FY 2009, the joint HEP/NP initiative was operating facilities with an aggregate capacity of 18 sustained teraflops. This LQCD initiative is being replaced by a joint 5-year HEP/NP follow-on project, LQCD-ext, beginning in FY 2010. The NP LQCD computer capability at TJNAF is also being augmented with Recovery Act funding; when fully operational at the end of FY 2010, this computing equipment will have increased the U.S. computing capability for LQCD to a minimum of 45 sustained teraflops.

The Nuclear Theory subprogram also sponsors the Institute for Nuclear Theory (INT) at the University of Washington, which carries out a range of activities in support of the work of the nuclear physics community. INT includes visiting scientists, research fellows, postdoctoral fellows, graduate students, and several leading nuclear theorists as permanent staff; its organizational structure promotes cost effective collaboration and educational opportunities. INT also hosts a series of specialized research programs on specific topics in nuclear theory and related fields that are identified by the research community as being of high priority. The Nuclear Theory subprogram also supports targeted investments in short-term topical theory collaborations within the university and national laboratory communities to facilitate cooperation and communication on specialized nuclear theory challenges that require concerted effort in order to advance the field.

Another component of the Nuclear Theory subprogram is the National Nuclear Data program which compiles, evaluates, and disseminates nuclear data for basic research and applications in an online database that is readily accessible and user oriented.

The Nuclear Theory subprogram is strengthened by its interactions with complementary programs overseas, NSF-supported theory efforts, programs supported by the DOE HEP program, Japanese-supported theoretical efforts related to RHIC at the RIKEN Center at Brookhaven National Laboratory, and the Japan-U.S. Theory Institute for Physics with Rare Isotope Nuclei (JUSTIPEN) at RIKEN in Wako, Japan.

The FY 2011 increases address staff shortages at the national laboratories, the ramp-up of the second-generation LQCD project in partnership with the DOE Office of High Energy Physics, and additional topical theory collaboration support. Within the Nuclear Data subprogram, support for the recently initiated Applications of Nuclear Science and Technology program is reduced due to opportunities enabled by Recovery Act funding.

Selected FY 2009 Accomplishments

- The quark-gluon plasma (QGP), studied experimentally in relativistic heavy-ion collisions at the RHIC facility at BNL, has continued to be of great interest to nuclear theorists. Advances this past year include a more realistic description of the QGP using viscous fluid dynamics. Lattice Quantum Chromodynamics (LQCD) calculations have provided the value of the viscosity coefficients in a gluon plasma, yielding clear confirmation that the QGP is not a nearly free gas of quarks and gluons but instead behaves as a nearly perfect fluid.
- Meson-baryon interactions play an important role in nuclear physics and potentially also in astrophysics. During the last year, the first fully dynamical LQCD calculation of meson-baryon scattering was performed by the Nuclear Physics LQCD collaboration, demonstrating that the longstanding building blocks of nuclear structure calculations are accountable to the underlying quark-gluon degrees of freedom. This is only the beginning of the LQCD effort in this area, but it is an important step towards determining meson-baryon interaction strengths and quantifying the associated systematic uncertainties.
- In Low Energy Nuclear Physics, the question of "How far does the periodic table go?" and the accompanying technical challenge of how best to form new elements experimentally have been the focus of great attention. Recent calculations using microscopic density functional theory suggest possibly very favorable experimental approaches for creating new heavy elements and may also provide a wider context for understanding fission reactions such as those exploited in energy-producing nuclear reactors. These studies have also led to a better theoretical understanding of aspects of nuclear structure that were already known experimentally, including the mass differences

between nuclei with even and odd numbers of neutrons and protons and properties of the excited states of even nuclei. This work includes many predictions that can be tested at the planned FRIB facility.

- In recent observations of the Sun, improved analyses of absorption lines in the solar spectrum have lowered estimates of the Sun's surface metal content (metallicity). These new results lead to a puzzling discrepancy with predictions of the speed of sound in the solar interior using the standard solar model. This demonstrates the importance of developing improved three-dimensional solar models using the next generation of supercomputers. It was also recently shown that new solar neutrino flux experiments could resolve this solar metallicity puzzle by directly determining the metal content of the gas cloud from which our solar system formed.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Theory Research	**30,712**	**33,922**	**36,210**
- **University Research**	**14,551**	**15,060**	**15,753**

The University Research activity supports the research of approximately 160 academic scientists and 120 graduate students through 65 research grants at 45 universities in 29 states and the District of Columbia, and will allow the start of several new research grants in specific growth areas of nuclear theory in FY 2011. Funding will support the necessary level of theoretical effort needed for interpretation of experimental results obtained at the NP facilities and the training of next-generation nuclear theorists. The overall nuclear theory effort is aligned with the experimental program through the program performance milestones established by NSAC.

	FY 2009	FY 2010	FY 2011
- **National Laboratory Research**	**13,482**	**16,089**	**17,587**

Research programs in nuclear theory are supported at seven national laboratories (ANL, BNL, LANL, LBNL, LLNL, ORNL, and TJNAF) to achieve high priority scientific goals and interpret experimental results. The theoretical research at a given laboratory is primarily aligned to the experimental program at that laboratory, or in some cases to take advantage of the unique facilities or programs at that laboratory. In FY 2011, funding is provided for staffing at several of the national laboratories, and investments in LQCD computer capabilities are increased slightly in a joint effort with High Energy Physics, LQCD-ext. Additional topical theory collaboration support is also provided. Funds for topical theory collaborations are reflected in National Laboratory Research, but are awarded after open competition between university and laboratory groups; awards are determined by peer review. In FY 2009, the seven laboratory groups were evaluated on the significance of their accomplishments and planned future program; scientific leadership, creativity and productivity of the personnel; and the overall cost-effectiveness of the group. The results of this review will influence final budget allocations in FY 2010 and FY 2011.

	FY 2009	FY 2010	FY 2011
- **Scientific Discovery through Advanced Computing (SciDAC)**	**2,679**	**2,773**	**2,870**

SciDAC is a collaborative program that partners scientists and computer experts in research teams to address major scientific challenges that require supercomputer facilities at the current technological limits. The NP SciDAC program currently supports research projects in nuclear astrophysics, grid

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

computing, lattice quantum chromodynamics, low energy nuclear structure and nuclear reaction theory, and advanced accelerator design, which are jointly funded with ASCR, HEP, and NNSA. The portfolio of NP-supported SciDAC projects will be re-competed in FY 2010 and FY 2011, and a new set of these computationally intensive projects of nuclear theory will be under investigation in FY 2011.

	FY 2009	FY 2010	FY 2011
Nuclear Data Activities	**7,064**	**7,652**	**8,499**

This effort involves the work of several national laboratories and universities and is guided by the DOE-managed National Nuclear Data Center (NNDC) at BNL. Funding addresses long-standing staffing issues. The NNDC relies on the U.S. Nuclear Data Network, a network of DOE-supported individual nuclear data professionals located in universities and national laboratories that perform assessment as well as developing modern network dissemination capabilities. The NNDC participates in the International Data Committee of the International Atomic Energy Agency.

Funding is also provided to support initiatives in Applications of Nuclear Science and Technology, including efforts relevant to nuclear fuel cycles. This initiative is funded from both the Low Energy Program and the Nuclear Data Program; while funding increases in this subprogram, overall the support for this initiative decreases in FY 2011 as compared to FY 2010.

	FY 2009	FY 2010	FY 2011
Total, Nuclear Theory	**37,776**	**41,574**	**44,709**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Theory Research	
▪ **University Research** In FY 2011, increased support is provided to university nuclear theory groups to continue research on the topics in theoretical nuclear physics that were identified in the previous NSAC report on performance measures and milestones and to implement recommendations from the NSAC Subcommittee on Nuclear Theory.	+693
▪ **National Laboratory Research** FY 2011 funding provides an increase above cost of living for the theoretical efforts at the seven NP-supported national laboratory theory groups to allow these groups to achieve the scientific goals of the Nuclear Physics program. These activities include increasing staff, additional topical collaboration support, and the increased support of the LQCD initiative, LQCD-ext, which is jointly funded with HEP.	+1,498
▪ **Scientific Discovery through Advanced Computing (SciDAC)** The portfolio of NP-supported SciDAC projects will be re-competed in FY 2010 and FY 2011. Funding in FY 2011 will allow support for the newly defined set of	

	FY 2011 vs. FY 2010 ($000)
computationally intensive SciDAC projects in nuclear theory that require terascale and petascale computing capabilities.	+97
Total, Theory Research	**+2,288**
Nuclear Data Activities	
FY 2011 funding will continue to support the activities of the National Nuclear Data Center and institutions that collaborate on the Nuclear Data project at a near constant level of effort (+$325,000), and support for the Applications of Nuclear Science and Technology initiative increases in this subprogram (+$522,000).	+847
Total Funding Change, Nuclear Theory	**+3,135**

Isotope Development and Production for Research and Applications

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Isotope Development and Production for Research and Applications			
Research			
National Laboratory Research	1,500	1,500	1,560
University Research	3,360	1,500	1,560
Other Research[a]	0	84	90
Total, Research	4,860	3,084	3,210
Operations			
University Operations	200	250	262
Isotope Production Facility Operations	2,790	1,068	1,111
Brookhaven Linear Isotope Producer Operations	770	500	520
National Isotope Data Center (NIDC)	1,024	1,915	1,992
Other National Laboratory Operations	15,116	12,383	12,685
Total, Operations	19,900	16,116	16,570
Total, Isotope Development and Production for Research and Applications	24,760	19,200	19,780

Description

The primary goal of this subprogram is to support research, development, and production of research and commercial isotopes that are of critical importance to the Nation and in short supply. To achieve this goal, the Isotope Development and Production for Research and Applications subprogram provides facilities and capabilities for the production of research and commercial stable and radioactive isotopes, scientific and technical staff associated with general isotope research and production, and a supply of critical isotopes to address the needs of the Nation. The immediate benefits of a viable isotope production component of the Isotope Development and Production for Research and Applications subprogram include the availability of research and commercial isotopes that would have otherwise not be possible, reduced dependence on foreign supplies, new scientific applications for isotopes not currently supplied, the development of more effective isotope production and processing techniques, and the ability to meet both present and future research needs for isotopes. The subprogram places an emphasis on the R&D efforts associated with developing new and more cost-effective and efficient production and processing techniques, and the production of isotopes needed for research purposes.

Stable and radioactive isotopes are vital to the mission of many Federal agencies and play a crucial role in basic research, medicine, industry, and homeland defense. Isotopes produced by the program are utilized by Federal agencies, including the National Institutes of Health and their grantees, National

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[a] In FY 2009, $125,000 was transferred to the SBIR program and $15,000 was transferred for the STTR program. This activity includes $75,000 for SBIR and $9,000 for STTR in FY 2010 and $80,000 for SBIR and $10,000 for STTR in FY 2011.

Institute of Standards and Technology, Environmental Protection Agency, Department of Agriculture, National Nuclear Security Administration, Department of Homeland Security, other DOE Office of Science programs, and other Federal agencies.

Isotopes are used to improve the accuracy and effectiveness of medical diagnoses and therapy, enhance national security, improve the efficiency of industrial processes, and provide precise measurement and investigative tools for materials, biomedical, environmental, archeological, and other research. Some examples are: strontium-82 used for heart imaging; germanium-68 used for calibrating the growing numbers of imaging scanners; arsenic-73 used as a tracer for environmental research; and nickel-63 used as a component in gas sensing devices or helium-3 as a component in neutron-detectors, both for applications in homeland defense. Some isotopes are critical resources to very diverse operations in industry and science and have a profound impact on the Nation's economy and national security. Californium-252, for example, is used in a wide array of applications for medicine, homeland defense, and energy security. The consequences of shortages of radioactive and stable isotopes needed for research, medicine, homeland security, and industrial applications can be extremely serious ranging from the inability to treat cancer to the failure to detect terrorist threats.

Isotopes are made available by using the Department's unique facilities, the Brookhaven Linac Isotope Producer (BLIP) at BNL and the Isotope Production Facility (IPF) at LANL, for which the subprogram has stewardship responsibilities. In FY 2009, the subprogram also explored production capabilities at university and other laboratory facilities in order to make high priority isotopes more available and cost-effective. Hot cell facilities at Brookhaven, Oak Ridge, and Los Alamos National Laboratories are used and maintained by the program for processing and handling irradiated materials and purified products. Facilities at other national laboratories are used as needed, such as the production of isotopes at the reactors at Oak Ridge and Idaho National Laboratories and processing and packaging strontium-90 from the Pacific Northwest National Laboratory. Over 50 researchers and staff at the national laboratories are supported to provide the technical expertise in research, development, and transportation of isotopes. Research and development includes target fabrication, enhanced processing techniques, radiochemistry, material conversions, and other related services.

The Isotope Program was transferred to the Office of Nuclear Physics with the FY 2009 Appropriation, and much effort has been expended on establishing long-term strategies, priorities, peer review mechanisms, and effective lines of communication with isotope stakeholders. The Nuclear Science Advisory Committee (NSAC) was charged in August 2008 to develop a prioritized list of research topics using isotopes, and to develop a long-range strategic plan for stable and radioactive isotope production. The first NSAC report, released in April 2009, includes federal, commercial, and community input and establishes priorities for the production of research isotopes. Following release of the report, NP issued a broad call to university, laboratory, and commercial facilities, inviting them to submit proposals describing their capabilities for producing these high priority research isotopes. These proposals were reviewed and selections were made based on cost and products in short supply; the result is that the Isotope Program will establish new production capabilities at other laboratory sites and university facilities to optimize its ability to supply reliable sources of research isotopes at more affordable prices. A data call is now planned to the broad research community announcing the isotopes that can be produced at the increased suite of facilities and soliciting interest in the demand for these isotopes so that production schedules can be developed and coordinated. The second NSAC report on a long-range strategic plan was released in November 2009.[a]

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[a] http://www.sc.doe.gov/np/dev/nsac/nsac.html

NP continues to work in close collaboration with other federal agencies in the development of strategic plans regarding isotope production. A goal of the program is to establish effective communication with federal agencies to better forecast isotope needs and leverage resources. For example, NP continues to work with the National Institutes of Health (NIH) on a federal working group NP assembled to address the recommendations of the recent National Academies report, *Advancing Nuclear Medicine through Innovation*, which identified several areas in isotope production warranting attention. A five-year production strategy has been generated which identifies the isotopes and projected quantities needed by the medical community in the context of the Isotope Program capabilities. While the Isotope Program is not responsible for the production of molybedenum-99 (Mo-99), it recognizes the importance of this isotope for the Nation and is working closely with DOE/NNSA, the lead entity responsible for domestic Mo-99 production, by offering technical and management support. NP has also facilitated the formation of a federal working group on the He-3 supply issue involving staff from NP, NNSA, the Department of Homeland Security, and the Department of Defense. The Isotope Program's role in helium-3 (He-3) is limited to packaging and distribution of the isotope. However, the objective of this working group is to ensure that the limited supply of He-3 will be distributed to the highest priority applications and basic research.

In addition, NP held many discussions during FY 2009 with the Californium-252 (Cf-252) source manufacturers and users, conducted a full bottom-up evaluation of the costs associated with Cf-252 production, and considered more effective approaches to produce this isotope to meet projected demands. The result is that a four-year contract was signed with the source manufacturers in May 2009 to continue Cf-252 production and ensure its availability in the outyears.

The Isotope Development and Production for Research and Applications subprogram, which operates under a revolving fund as established by the FY 1990 Energy and Water Development Appropriations Act (Public Law 101–101) as modified by Public Law 103–316, maintains its financial viability by utilizing a combination of Congressional appropriations and revenues from the sale of isotopes and services. These resources are used to maintain the staff, facilities, and capabilities at user-ready levels and to support peer-reviewed research and development activities related to the production of isotopes. Commercial isotopes are priced at full cost. Research isotopes are priced at more affordable rates, with research isotopes sold at a unit price. Investments in new capabilities are made to meet the growing demands of the Nation and foster research in the applications that will support the health and welfare of the public.

In FY 2011,emphasis is placed on supporting and organizing a stable and efficient workforce for the production of isotopes and R&D efforts. The suite of isotope production facilities is increased to include university facilities and other capabilities at national laboratories. Starting in FY 2010, the Isotope Program will increase productivity by broadening its suite of facilities to include university accelerator and reactor facilities, as well as other agency facilities, which can provide cost-effective and unique capabilities; these include cyclotron facilities at the National Institutes of Health, the Washington University cyclotron, the University of California at Davis cyclotron and the Missouri University Research Reactor. Partnerships with industrial counterparts are pursued to leverage resources. Under the research category, FY 2009 funding reflects the outcome of decisions based upon peer review regarding production of isotopes at university and national laboratory facilities, and their corresponding balance. It is expected that in FY 2010 and FY 2011 that balance will be optimized based on merit peer review.

Selected FY 2009 Accomplishments

- Copper-67 is an attractive radioisotope for application in therapy of various cancers when attached to the appropriate carrier molecule, such as a monoclonal antibody. In an ongoing effort to improve the specific activity of copper-67, BNL has investigated the use of a highly enriched zinc-68 target in place of natural zinc. A test irradiation with zinc-68 improved the specific activity three-fold over the best previous result. In order to improve the economics of this process, a method to recover and reuse the enriched material from the process waste was successfully developed.

- A Drug Master File for the tungsten-188/rhenium-188 generator system, used in cancer research, is now on file with the Food and Drug Administration. Coupled with the hot cells at ORNL now being approved for current Good Manufacturing Practices, the tungsten-188/rhenium-188 generator will be suitable for human clinical trials.
- Recent major equipment purchases of stable isotope processing equipment at ORNL will greatly enhance stable isotope supply. A new high vacuum/induction heating system replaced one that was over 40 years old and contained legacy thorium contamination, and a new scanning electron microscope with an x-ray energy dispersive analyzer will allow for enhanced chemistry and materials product and process evaluation.
- Yttrium-86 is a short-lived isotope emitting positrons, which can be used for positron emission tomography (PET) imaging prior to cancer immunotherapy with yttrium-90. Yttrium-86 labeled tumor-seeking monoclonal antibodies can be used for evaluating effective tumor uptake and radiation dose. Currently this isotope is in short supply. A number of activities have been undertaken to increase the reliable supply of yttrium for use in research: investigations to improve product purity using very low energy protons; development of a method to recover irradiated strontium-86 for reuse; design of a new target capsule that can be sealed and opened in a hotcell; and development of a new accelerator tune to reduce the BLIP facility beam energy from the maximum of 200 MeV to 66 MeV in order to more effectively produce the isotope.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	**4,860**	**3,084**	**3,210**

Research is supported to identify, design, and optimize production targets and separation methods. Examples for planned research include the need for positron-emitting radionuclides to support the rapidly growing area of medical imaging using PET, the development of isotopes that support medical research to be used to diagnose and treat diseases spread through acts of bioterrorism, the development of production methods for alpha-emitting radionuclides that exhibit great potential in disease treatment, the development and use of research isotopes for various biomedical applications, and the need for alternative isotope supplies for national security applications and advanced power sources. Priorities in research isotope production are informed by guidance from NSAC. All R&D activities are peer reviewed. In addition, Recovery Act funding is being used to support R&D in alternative isotope production techniques, which complements these research efforts in FY 2010.

▪ **National Laboratory Research**	**1,500**	**1,500**	**1,560**

Support is provided for scientists at the national laboratories (BNL, LANL, ORNL, INL, PNNL) to perform peer-reviewed experimental research on targets, separation technology maturation and development of isotope production techniques, and for the production of research isotopes at more affordable rates. R&D activities also utilize the reactors at INL and ORNL and the accelerators at LANL and BNL. Researchers provide unique expertise and facilities for data analysis. Funding in FY 2009 reflects the selection of national laboratory proposals following peer review. Amounts

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

reflected in FY 2010 and FY 2011 are estimates; the actual split of funding between National Laboratory Research and University Research will be determined based on merit peer review. Additional funding was provided in FY 2009 under the Recovery Act for R&D on alternative isotope production and processing techniques.

- **University Research** **3,360** **1,500** **1,560**

  Support is provided for scientists at universities and with industry to perform peer-reviewed experimental research on targets, separation technology maturation and development of isotope production techniques, and for the production of research isotopes at more affordable rates. Funding in FY 2009 reflects the selection of university and industry proposals. Amounts reflected in FY 2010 and FY 2011 are estimates; the actual split of funding between University Research and National Laboratory Research will be determined based on merit peer review.

- **Other Research** **0** **84** **90**

  In FY 2009, $125,000 was transferred to the Small Business Innovation Research (SBIR) program and $15,000 was transferred to the Small Business Technology Transfer (STTR) program. This activity includes $75,000 for SBIR and $9,000 for STTR in FY 2010 and $80,000 for SBIR and $10,000 for STTR in FY 2011.

Operations **19,900** **16,116** **16,570**

Operations funding is provided to support the core facility scientists and engineers needed to effectively operate the Isotope Development and Production for Research and Applications facilities, and includes facility maintenance and investments in new facility capabilities. In addition, Recovery Act funding is supporting enhanced utilization of isotope facilities, including additional isotope production and one-time investments in infrastructure and new capabilities.

- **University Operations** **200** **250** **262**

  Funding is provided to academic institutions with reactors and cyclotrons for providing capabilities in the production and processing of isotopes to complement or increase the subprogram's isotope portfolio. Research isotope production at universities and national laboratories is supported under the research category above.

- **Isotope Production Facility (IPF) Operations** **2,790** **1,068** **1,111**

  The IPF operates in a parallel-mode in accordance with the Los Alamos Neutron Science Center (LANSCE) for about 22 weeks in FY 2011; the IPF is completely dependent upon the operations of LANSCE. The IPF produces isotopes such as germanium-68, strontium-82, and arsenic-73. Support is provided in FY 2011 for the operation, maintenance, and improvement of the IPF, including radiological monitoring, facility inspections, and records management. Upgrades at IPF, including one-time costs for replacement of the control and target loading systems, were funded in FY 2009 and with Recovery Act funding.

- **Brookhaven Linac Isotope Producer (BLIP) Operations** **770** **500** **520**

  BLIP operates in parallel mode in accordance with the RHIC operating schedule and additionally in dedicated mode to meet customer needs. BLIP produces isotopes such as copper-67, germanium-68,

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

and strontium-82. Support is provided in FY 2011 for the operation, maintenance, and improvement of BLIP, including radiological monitoring, facility inspections, and records management. Several one-time equipment upgrades were funded in FY 2009 and with Recovery Act funding.

	FY 2009	FY 2010	FY 2011
▪ **National Isotope Data Center (NIDC)**	**1,024**	**1,915**	**1,992**

The National Isotope Data Center (NIDC) is a newly created management information center for all national laboratories and universities in the subprogram's portfolio producing and distributing isotopes. The NIDC coordinates and integrates multi-laboratory isotope production schedules, maintains isotope inventory balances and transportation container inventory and certifications, and conducts various outreach and societal activities. The business office within the NIDC is located at ORNL and coordinates all customer data such as official quotations, account balances, shipping schedules and delivery tracking, and other pertinent information. Funding is provided in FY 2010 and FY 2011 to support the staff that are needed to oversee these activities.

	FY 2009	FY 2010	FY 2011
▪ **Other National Laboratory Operations**	**15,116**	**12,383**	**12,685**

The Isotope program makes intensive use of hot cell facilities at the three main isotope production sites: BNL, LANL, and ORNL. Funding is provided to each of these facilities for the technical expertise and hot cell facilities in order to support the handling and processing of radioactive materials. Support is provided in FY 2011 for the Chemical and Material Laboratories at ORNL that is used for processing stable isotopes, as well as activities including radiological monitoring, facility inspections, records management, the certification of isotope shipping casks, and other related expenses. The one-time costs for modernization of the train control system to meet current facility requirements at LANL and relocation of sub-category-3 level quantities of radioisotope materials at ORNL were funded in FY 2009. In addition, several upgrade projects were supported with Recovery Act funding. FY 2011 funding maintains efforts at approximately constant effort, relative to FY 2010.

	FY 2009	FY 2010	FY 2011
Total, Isotope Development and Production for Research and Applications	**24,760**	**19,200**	**19,780**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research	
Funding for research and development, which is guided by priorities in research isotope production developed by NSAC, is maintained at constant effort in FY 2011. R&D efforts benefited significantly from Recovery Act funding for R&D on alternative isotope production techniques.	+126
Operations	
▪ **University Operations**	
Funding maintains constant effort.	+12

	FY 2011 vs. FY 2010 ($000)
▪ **Isotope Production Facility (IPF) Operations**	
Funding maintains constant effort.	+43
▪ **Brookhaven Linac Isotope Producer (BLIP) Operations**	
Funding maintains constant effort.	+20
▪ **National Isotope Data Center (NIDC)**	
An increase is provided to maintain constant effort for the NIDC to meet its mission to coordinate isotope activities and customer data.	+77
▪ **Other National Laboratory Operations**	
Funding maintains constant effort at the hot cell facilities.	+302
Total, Operations	**+454**
Total Funding Change, Isotope Development and Production for Research and Applications	**+580**

Construction

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Construction			
07-SC-02, Electron Beam Ion Source, BNL	2,438	0	0
06-SC-01, 12 GeV CEBAF Upgrade (PED/Construction), TJNAF	28,623	20,000	36,000
Total, Construction	31,061	20,000	36,000

Description

This subprogram provides for Construction and Project Engineering and Design (PED) that is needed to meet overall objectives of the Nuclear Physics program.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
07-SC-02, Electron Beam Ion Source, BNL	**2,438**	**0**	**0**

The Electron Beam Ion Source (EBIS) project to replace the high maintenance tandems as the RHIC pre-injector, leading to more cost effective operations and new research capabilities, will be completed in FY 2010 with funding appropriated in previous years. This project was jointly supported by NP and NASA.

	FY 2009	FY 2010	FY 2011
06-SC-01, 12 GeV CEBAF Upgrade (PED/Construction), TJNAF	**28,623**	**20,000**	**36,000**

In FY 2011, funding is requested to continue construction of the 12 GeV CEBAF Upgrade. The upgrade was identified in the 2007 NSAC Long-Range Plan as the highest priority for the U.S. Nuclear Physics program and is a near-term priority in the SC 20-Year Facilities Outlook. The upgrade will enable scientists to address one of the mysteries of modern physics—the mechanism of quark confinement. In addition to the funding reflected above, the project also received Recovery Act funding of $65,000,000 in FY 2009 which advanced a portion of the original FY 2010 and FY 2011 planned funding. The FY 2010 and FY 2011 requests reflect a total of $65,000,000 in reductions to the originally planned funding profile to account for the advanced Recovery Act funding.

	FY 2009	FY 2010	FY 2011
Total, Construction	**31,061**	**20,000**	**36,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
06-SC-01, 12 GeV CEBAF Upgrade (PED/Construction), TJNAF	
Support is provided to continue construction of the 12 GeV CEBAF Upgrade according to the planned profile after taking into account advanced funding provided under the Recovery Act, and the FY 2010 Appropriation.	+16,000

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	421,951	463,951	481,208
Capital Equipment	38,810	42,571	37,497
General Plant Projects	2,330	2,000	2,000
Accelerator Improvement Projects	6,155	6,478	5,295
Construction	31,061	20,000	36,000
Total, Nuclear Physics	500,307	535,000	562,000

Funding Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research	157,709	185,233	196,235
Scientific User Facilities Operations	260,118	272,730	279,916
Other Facility Operations	23,732	20,369	20,993
Projects			
Major Items of Equipment	15,063	18,918	12,805
Facility for Rare Isotope Beams[a]	7,000	12,000	10,000
Construction Projects	31,061	20,000	36,000
Total Projects	53,124	50,918	58,805
Other	5,624	5,750	6,051
Total Nuclear Physics	500,307	535,000	562,000

Scientific User Facilities Operations and Research

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RHIC (BNL)			
Operations	148,684	157,470	163,301
Facility Research/MIEs	10,427	9,032	10,797
Total RHIC	159,111	166,502	174,098

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[a] FRIB is being funded with operating expense dollars through a Cooperative Agreement with Michigan State University (MSU).

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
CEBAF (TJNAF)			
Operations	80,394	82,522	83,245
Facility Research/MIEs	10,301	9,799	10,648
Total CEBAF	90,695	92,321	93,893
HRIBF (ORNL)			
Operations	15,860	16,645	17,174
Facility Research/MIEs	6,103	4,068	4,805
Total HRIBF	21,963	20,713	21,979
ATLAS (ANL)			
Operations	15,180	16,093	16,196
Facility Research/MIEs	5,223	4,700	5,035
Total ATLAS	20,403	20,793	21,231
Scientific User Facilities			
Operations	260,118	272,730	279,916
Facility Research/MIEs	32,054	27,599	31,285
Total Scientific User Facilities	292,172	300,329	311,201

Total Facility Hours and Users

	FY 2009	FY 2010	FY 2011
Hours of Operation with Beam			
RHIC (BNL)			
Achieved Operating Hours	3,153	N/A	N/A
Planned Operating Hours	2,915	3,350	3,720
Optimal Hours	4,100	4,100	4,100
Percent of Optimal Hours	77%	82%	91%
Unscheduled Downtime	19.7%	N/A	N/A
Number of Users	1,200	1,200	1,200

	FY 2009	FY 2010	FY 2011
CEBAF (TJNAF)			
Achieved Operating Hours	5,117	N/A	N/A
Planned Operating Hours	4,965	5,110	4,090
Optimal Hours	5,980	5,980	5,980[a]
Percent of Optimal Hours	86%	86%	68%
Unscheduled Downtime	8.5%	N/A	N/A
Number of Users	1,350	1,390	1,430
HRIBF (ORNL)			
Achieved Operating Hours	4,653	N/A	N/A
Planned Operating Hours	3,600	5,200	5,200
Optimal Hours	6,100	6,100	6,100
Percent of Optimal Hours	76%	85%	85%
Unscheduled Downtime	14.7%	N/A	N/A
Number of Users	260	260	260
ATLAS (ANL)			
Achieved Operating Hours	5,488	N/A	N/A
Planned Operating Hours	5,200	5,900	5,900
Optimal Hours	6,600	6,600	6,600
Percent of Optimal Hours	83%	89%	89%
Unscheduled Downtime	4.1%	N/A	N/A
Number of Users	360	410	410
Total Facilities			
Achieved Operating Hours	18,411	N/A	N/A
Planned Operating Hours	16,680	19,560	18,910
Optimal Hours	22,780	22,780	22,780
Percent of Optimal Hours	81%	86%	83%
Unscheduled Downtime	11%	<20%	<20%
Total Number of Users	3,170	3,260	3,300

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[a] While the optimal operations for CEBAF remains at 5,980 hours, the maximum number of hours the facility can operate in FY 2011 is 4,090 hours due to a planned shutdown for installation of 12 GeV components. The facility therefore operates at 100% of maximal hours.

Major Items of Equipment

	Prior Years	FY 2009	FY 2009 Recovery Act Appropriation	FY 2010	FY 2011	Outyears	Total
Heavy Ion Nuclear Physics							
Heavy Ion LHC Experiments, LBNL							
TEC	3,000	4,000	0	5,000	1,205	0	13,205
OPC	295	0	0	0	0	0	295
TPC	3,295	4,000	0	5,000	1,205	0	13,500
PHENIX Silicon Vertex Tracker, BNL							
TEC/TPC	3,599	851	250	0	0	0	4,700
PHENIX Forward Vertex Detector, BNL							
TEC/TPC	700	2,200	2,000	0	0	0	4,900
STAR Heavy Flavor Tracker, BNL							
TEC	0	0	0	1,400	2,900	TBD	TBD
OPC	0	0	0	0	0	TBD	TBD
TPC	0	0	0	1,400	2,900	TBD	11,000–17,000
Low Energy Nuclear Physics							
GRETINA, Gamma-Ray Detector, LBNL							
TEC	14,570	2,000	0	430	0	0	17,000
OPC	1,200	300	0	300	0	0	1,800
TPC	15,770	2,300	0	730	0	0	18,800
Fundamental Neutron Physics Beamline, ORNL							
TEC	7,100	1,500	600	0	0	0	9,200
OPC	88	0	0	0	0	0	88
TPC	7,188	1,500	600	0	0	0	9,288
Neutron Electric Dipole Moment (nEDM), LANL							
TEC	2,947	1,100	0	4,500	2,900	TBD	TBD
OPC	933	0	0	0	0	TBD	TBD
TPC	3,880	1,100	0	4,500	2,900	TBD	17,600–19,000

	Prior Years	FY 2009	FY 2009 Recovery Act Appropriation	FY 2010	FY 2011	Outyears	Total
Cryogenic Underground Observatory for Rare Events (CUORE), LBNL							
TEC	400	3,112	0	3,088	800	186	7,586
OPC	764	0	0	0	0	350	1,114
TPC	1,164	3,112	0	3,088	800	536	8,700
Rare Isotope Beam Science Initiatives							
TEC	0	0	0	4,200	5,000	TBD	TBD
OPC	0	0	0	0	0	TBD	TBD
TPC	0	0	0	4,200	5,000	TBD	2,000–20,000
Total MIEs							
TEC		14,763	2,850	18,618	12,805		
OPC		300	0	300	0		
TPC		15,063	2,850	18,918	12,805		

Heavy Ion Nuclear Physics MIEs

Heavy Ion LHC Experiment (ALICE EMCal), LBNL: This MIE fabricates a large electromagnetic calorimeter (EMCal) for the ALICE experiment at the LHC, and is a joint project with France and Italy. It received CD-2/3 approval in February 2008 and is scheduled to finish in FY 2011.

PHENIX Silicon Vertex Tracker (VTX), BNL: This MIE fabricates a barrel of silicon pixel and strip detectors for high-precision tracking and vertexing and is a joint project with Japan. The TPC was baselined at a technical, cost, schedule, and management review in May 2006 and the project is scheduled to finish in FY 2010. The project received its final funding of $250,000 under the Recovery Act.

PHENIX Forward Vertex Detector (FVTX), BNL: This MIE fabricates two silicon endcaps to extend the VTX tracking and vertexing capabilities. The TPC was baselined at a technical, cost, schedule, and management review in November 2007. The project is scheduled to finish in FY 2011. The project received its final funding of $2,000,000 under the Recovery Act.

STAR Heavy Flavor Tracker (HFT), BNL: This MIE will fabricate a high-precision tracking and vertexing device based on ultra-thin silicon pixel and pad detectors in the STAR detector. It received CD-0 approval in February 2009 and is scheduled for initiation in FY 2010 and completion in FY 2014.

Low Energy Nuclear Physics MIEs

GRETINA Gamma-Ray Detector, LBNL: This MIE fabricates an array of highly-segmented germanium crystals for gamma ray detection. It received CD-2/3 approval in October 2007 and is scheduled to finish in FY 2011. This detector will be shared by the Nation's low-energy accelerator facilities operated by both DOE and NSF.

Fundamental Neutron Physics Beamline (FNPB), ORNL: This MIE fabricates two beam lines at the SNS to deliver record peak currents of cold and ultra-cold neutrons for studies of fundamental neutron properties. It received CD-4a approval in September 2008 and is scheduled to finish in FY 2010. The project received its final funding of $600,000 under the Recovery Act. The scope funded with Recovery Act funding was completed in November 2009.

Neutron Electric Dipole Moment (nEDM), LANL: This MIE fabricates a cryogenic apparatus to measure the neutron electric dipole moment using ultra-cold neutrons from the FNPB. It received CD-1 approval in February 2007. Engineering design and R&D efforts continued in FY 2009 and FY 2010 for this high-risk project. Fabrication, scheduled to start in FY 2010, will be initiated once the project completes high priority R&D and is baselined and has CD-2 approval. This is a joint DOE/NSF project with NSF contributing additional funds.

Cryogenic Underground Observatory for Rare Events (CUORE), LBNL: This MIE fabricates the U.S. contribution to the Italian-led CUORE experiment to measure fundamental neutrino properties. It received CD-2/3 approval in December 2009 and is scheduled to finish in FY 2013. This is a joint DOE/NSF project with NSF contributing additional funds.

Rare Isotope Beam Science Initiatives: These initiatives consist of multiple initiatives, each ranging in TPC between $2–20 million, to fabricate instrumentation creating forefront science opportunities at leading rare isotope beam facilities around the world. They received CD-0 approval in February 2009 and are scheduled for initiation in FY 2010 and completion between FY 2012 and FY 2017. The projects were selected following peer review of solicited proposals. Eleven initiatives were selected and are undergoing individual peer review in FY 2010; NP will break out and separately describe selected Major Items of Equipment in future budget narratives. No fabrication activities will be supported prior to project baseline or CD-2 approval.

Construction Projects

(dollars in thousands)

	Prior Years	FY 2009 Current Appropriation	FY 2009 Recovery Act Appropriation	FY 2010	FY 2011	Outyears	Total
12 GeV CEBAF Upgrade, TJNAF							
TEC	20,877	28,623	65,000	20,000	36,000	117,000	287,500
OPC	10,500	0	0	0	0	12,000	22,500
TPC	31,377	28,623	65,000	20,000	36,000	129,000	310,000
Electron Beam Ion Source, BNL							
TEC	11,262	2,438	0	0	0	0	13,700
OPC	800	300	0	0	0	0	1,100
TPC	12,062	2,738	0	0	0	0	14,800

(dollars in thousands)

	Prior Years	FY 2009 Current Appropriation	FY 2009 Recovery Act Appropriation	FY 2010	FY 2011	Outyears	Total
Total Construction							
TEC		31,061	65,000	20,000	36,000		
OPC		300	0	0	0		
TPC		31,361	65,000	20,000	36,000		

Scientific Employment

(estimated)

	FY 2009	FY 2010	FY 2011
# University Grants	190	200	200
Average Size per year	$340,000	$345,000	$345,000
# Laboratory Projects	33	33	34
# Permanent Ph.Ds	779	790	790
# Postdoctoral Associates	364	370	375
# Graduate Students	516	515	515
# Ph.D.s awarded	85	80	80

Facility for Rare Isotope Beams, Michigan State University, East Lansing, Michigan

1. Introduction

In 2008, DOE issued a Funding Opportunity Announcement (FOA) for the establishment, operations, and management of a rare isotope beam facility for nuclear structure and astrophysics research with overall technical capabilities as described in a 2007 Nuclear Science Advisory Committee (NSAC) study.[a] Michigan State University (MSU) was selected to design and establish the Facility for Rare Isotope Beams (FRIB) based on the evaluation of their application. MSU was awarded a Cooperative Agreement in June 2009.

FRIB is not a DOE line item construction project or capital asset and is being funded with operating expense dollars through a cooperative agreement with MSU. Although cooperative agreements are excluded under DOE O 413.3A, the management principles of DOE O 413.3A will be followed, including the approval of Critical Decisions. When completed, FRIB will be operated as a DOE National User Facility. Consistent with 10 CFR 600, real property and equipment acquired with Federal funds shall be vested with MSU. However, such items will not be encumbered by MSU for as long as the Federal government retains an interest. When the property and equipment are no longer of interest to the government, MSU will be responsible for decontamination and decommissioning.

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[a] http://www.sc.doe.gov/np/nsac/nsac.html

The most recent Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on February 9, 2004, with a preliminary cost estimate range of $900,000,000 to $1,100,000,000. However, as part of an alternatives analysis, the technical scope as originally conceived has changed and the new preliminary cost estimate range to the federal government is now $450,000,000 to $550,000,000 with a proposed completion date (CD-4) range of FY 2017 to FY 2019. The cooperative agreement between DOE and MSU identifies MSU providing $94.5 million in cost share. The final DOE federal investment will be determined when the project is more mature and ready to be baselined at CD-2.

While the requirements in DOE Order 413.3A are not applicable to cooperative agreements covered by 10 CFR 600, MSU is required to implement a project management system that is consistent with the widely accepted industry or DOE project management principles and standards/practices. Funds were appropriated in FY 2010 to continue work on R&D, conceptual design activities, and NEPA requirements. The FY 2011 request will initiate engineering and design activities.

2. Design and Construction Schedule[a]

	CD-0	CD-1	Design Complete	CD-2	CD-3	CD-4
FY 2011	02/09/2004	4Q 2010	TBD	TBD	TBD	FY 2017–FY 2019

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout

3. Baseline and Validation Status[b]

(dollars in thousands)

	TEC, Engineering and Design	TEC, Construction	TEC, Total	OPC	TPC
FY 2011	58,000	TBD	TBD	19,000	TBD

4. Project Description, Justification, and Scope

FRIB is based on a heavy-ion linac with a minimum energy of 200 MeV/u for all ions at beam power of 400 kW. The proposed facility will have a production area, three-stage fragment separator, three ion stopping stations, and post accelerator to reach at least 12 MeV/u for all ions.

This proposed facility is to provide intense beams of rare isotopes for a wide variety of studies in nuclear structure, nuclear astrophysics, and fundamental symmetries. This facility will impact the study of the origin of the elements and the evolution of the cosmos, and offers a laboratory for exploring the limits of nuclear existence and identifying new phenomena, with the possibility that a more broadly applicable theory of nuclei will emerge. The facility will offer new glimpses into the origin of the elements by leading to a better understanding of key issues by creating exotic nuclei that, until now, have existed only in nature's most spectacular explosion, the supernova. Experiments addressing questions of the fundamental symmetries of nature will similarly be conducted through the creation and study of certain exotic isotopes.

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[a] This project does not have a performance baseline. The CD-4 schedule range is a preliminary estimate.

[b] This project does not have a performance baseline. The preliminary DOE total project cost (TPC) range is $450,000,000 to $550,000,000, not including the MSU cost share. The amounts shown reflect the requested DOE appropriations only and do not include the planned cost share from MSU.

5. Financial Schedule (DOE only)

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
FY 2011	10,000	10,000	9,874
FY 2012	30,000	30,000	28,000
FY 2013	18,000[a]	18,000[b]	18,000[b]
FY 2014	TBD	TBD	2,126
Total, TEC[b]	58,000[b]	58,000[b]	58,000[b]
Other Project Cost (OPC)			
FY 2009	7,000	7,000	1,874
FY 2010	12,000	12,000	13,000
FY 2011	0	0	4,126
Total, OPC[c]	19,000	19,000	19,000
Total Project Cost			
FY 2009	7,000	7,000	1,874
FY 2010	12,000	12,000	13,000
FY 2011	10,000	10,000	14,000
FY 2012	30,000	30,000	28,000
FY 2013	18,000[a]	18,000[a]	18,000[a]
FY 2014	TBD	TBD	2,126
Outyears	TBD	TBD	TBD
Total, TPC[d]	TBD	TBD	TBD

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[a] In addition to the TEC funding of $18,000,000 reflected for engineering and design in FY 2013, funding will be requested for construction in FY 2013 and the outyears and will be included upon CD-2 approval.

[b] The funding reflected in the operating funded TEC profile is for DOE's share of engineering and design activities only. The total engineering and design cost is estimated to be $64,100,000; the DOE share shown is in anticipation that MSU will provide an additional $6,100,000 as their cost share. MSU's annual cost share may change as the project matures.

[c] The funding reflected in the OPC profile is for DOE's share of R&D, conceptual design, and NEPA activities only. The total OPC for these activities is estimated to be $25,500,000; the DOE share shown is in anticipation that MSU will provide an additional $6,500,000 as their cost share during this period. MSU's annual cost share may change as the project matures.

[d] The preliminary DOE total project cost (TPC) range is $450,000,000 to $550,000,000, not including the MSU cost share. The amounts shown reflect the requested DOE appropriations only and do not incude the planned cost share from MSU

6. Details of Cost Estimate (DOE only)

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Estimate
Total Estimated Cost (TEC)[a]			
Design and engineering	42,500	N/A	N/A
Construction	TBD	N/A	N/A
Contingency	15,500	N/A	N/A
Total, Total Estimated Cost	58,000	N/A	N/A
Other Project Cost (OPC)			
Conceptual Design / NEPA	6,500	N/A	N/A
R&D	12,500	N/A	N/A
Contingency	0	N/A	N/A
Total, OPC[b]	19,000	N/A	N/A
Total, TPC[c]	TBD	N/A	N/A
Total, Contingency	TBD	N/A	N/A

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Outyears	Total
FY 2010	TEC[d]	0	0	10,000	33,000	18,000[e]	TBD	TBD
	OPC[f]	7,000	9,000	0	0	0	TBD	TBD
	TPC[g]	7,000	9,000	10,000	33,000	18,000	TBD	TBD
FY 2011	TEC[a]	0	0	10,000	30,000	18,000[b]	TBD	TBD
	OPC[c]	7,000	12,000	0	0	0	TBD	TBD
	TPC[d]	7,000	12,000	10,000	30,000	18,000	TBD	TBD

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[a] The TEC funding is for DOE's share of engineering and design activities only at this time.

[b] The OPC funding is for DOE's share of R&D, conceptual design, and NEPA activities only at this time.

[c] The preliminary DOE total project cost (TPC) range is $450,000,000 to $550,000,000, not including the MSU cost share. The amounts shown reflect the requested DOE appropriations only and do not incude the planned cost share from MSU.

[d] The TEC funding is for DOE's share of engineering and design activities only at this time.

[e] In addition to the TEC funding of $18,000,000 reflected for engineering and design in FY 2013, funding will be requested for construction in FY 2013 and the outyears and will be included upon CD-2 approval.

[f] The OPC funding is for DOE's share of R&D, conceptual design, and NEPA activities only at this time.

[g] The preliminary DOE total project cost (TPC) range is $450,000,000 to $550,000,000, not including the MSU cost share. The amounts shown reflect the requested DOE appropriations only and do not include the planned cost share from MSU.

06-SC-01, 12 GeV CEBAF Upgrade, Thomas Jefferson National Accelerator Facility
Newport News, Virginia
Project Data Sheet is for PED/Construction

1. Significant Changes

This Project Data Sheet (PDS) is an update of the FY 2010 PDS.

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-3, Approve Start of Construction, which was signed on September 15, 2008, with a Total Project Cost (TPC) of $310,000,000 and CD-4 of FY 2015. Construction was authorized to begin under the FY 2009 Continuing Resolution at FY 2008 funding levels, and continued at the full FY 2009 appropriation level upon enactment in March 2009. In addition, the project received $65,000,000 in March 2009, from the American Recovery and Reinvestment Act of 2009 which advanced a portion of the original FY 2010 and FY 2011 planned funding. The FY 2010 and FY 2011 requests reflect a total of $65,000,000 in reductions to the originally planned funding profile to account for the advanced Recovery Act funding. Also in 2009, the Commonwealth of Virginia's appropriation bill included $6,000,000 to Jefferson Science Associates, LLC to leverage the federal investment in the 12 GeV CEBAF Upgrade. As of December 2009, $2,200,000 had been received, with the balance anticipated to arrive in two installments by April 2010. The Recovery Act and Commonwealth of Virginia funding are anticipated to reduce project risks associated with cost and schedule. Any adjustments to the federal government's share of the TPC as a result of the funding from the Commonwealth of Virginia will be evaluated by the SC Office of Project Assessment during the project's annual reviews. There have been no changes in project scope, cost, or schedule since the project was baselined. In addition, there have been no changes in the project risks. There are one high risk and three moderate risks associated with this project, each with a mitigation plan to achieve successful completion. A Federal Project Director at the appropriate level is assigned to this project.

2. Design, Construction, and D&D Schedule[a]

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	03/31/2004	1Q 2007	4Q 2009	4Q 2007	4Q 2008	1Q 2014	N/A	N/A
FY 2008	03/31/2004	2/14/2006[a]	4Q 2009	4Q 2007	4Q 2008	1Q 2015	N/A	N/A
FY 2009	03/31/2004	2/14/2006	4Q 2009	11/09/2007	4Q 2008	3Q 2015	N/A	N/A
FY 2010	03/31/2004	2/14/2006	4Q 2009	11/09/2007	09/15/2008	3Q 2015	N/A	N/A
FY 2011	03/31/2004	2/14/2006	1Q 2010	11/09/2007	09/15/2008	3Q 2015	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

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[a] CD-1 was approved on 2/14/2006. Engineering and design activities started in 4Q FY 2006 after Congress approved the Department of Energy's request to reprogram $500,000 within the FY 2006 funding for Nuclear Physics, per direction contained in H.Rpt 109–275.

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	21,000	TBD	TBD	11,000	TBD	TBD	TBD
FY 2008	21,000	TBD	TBD	10,500	TBD	TBD	TBD
FY 2009	21,000	266,500	287,500	22,500	N/A	22,500	310,000
FY 2010	21,000	266,500	287,500	22,500	N/A	22,500	310,000
FY 2011	21,000	266,500	287,500	22,500	N/A	22,500	310,000[a]

4. Project Description, Justification, and Scope

The Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility, or Jefferson Laboratory, is today the world-leading facility in the experimental study of hadronic matter. An energy upgrade of CEBAF has been identified by the nuclear science community as a compelling scientific opportunity that should be pursued. In particular, the Nuclear Science Advisory Committee (NSAC) stated in the 1996 Long Range Plan that "...the community looks forward to future increases in CEBAF's energy, and to the scientific opportunities that would bring." In the 2007 Long Range Plan, NSAC concluded that completion of the 12 GeV CEBAF Upgrade project was the highest priority for the Nation's nuclear science program.

- The 12 GeV CEBAF Upgrade directly supports the Nuclear Physics mission and addresses the objective to measure properties of the proton, neutron, and simple nuclei for comparison with theoretical calculations to provide an improved quantitative understanding of their quark substructure.
- The scope of the project includes upgrading the electron energy capability of the main accelerator from 6 GeV to 12 GeV, building a new experimental hall (Hall D) and associated beam-line, and enhancing the capabilities of the existing experimental halls to support the most compelling nuclear physics research.

Key Performance Parameters to achieve CD-4, *Approve Start of Operations or Project Closeout*, are phased around the accelerator and conventional facilities (CD-4A) and the experimental equipment in Halls B, C, and D (CD-4B). The deliverables defining completion are identified in the Project Execution Plan and have not changed since CD-2. Mitigation plans exist to help ensure that the one high risk and three moderate risks will not impact the planned completion dates.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

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[a] The Governor of Virginia signed House Bill 1600, the appropriation bill amending the 2008-2010 biennial budget for the Commonwealth of Virginia on March 30, 2009, which provided "$6,000,000 for Jefferson Science Associates, LLC to leverage a federal investment of $310 million for an upgrade of the Jefferson Lab's research facilities, which will maintain its leadership in the study of nuclear physics and secure the benefits of such a facility for the Commonwealth." It is anticipated that this funding will reduce project risks associated with cost and schedule and help ensure timely completion of the project if received. The project has received $2.2 million and anticipates receiving the balance in two more installments by April 2010. Any adjustments to the federal government's share of the TPC as a result of the funding from the Commonwealth of Virginia will be evaluated by the SC Office of Project Assessment during the project's annual reviews.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Total Estimated Cost (TEC)				
PED				
FY 2006	500	500	0	88
FY 2007	7,000	7,000	0	6,162
FY 2008	13,377[a]	13,377	0	9,108
FY 2009	123[a]	123	0	5,520
FY 2010	0	0	0	122
Total, PED	21,000	21,000	0	21,000
Construction				
FY 2009	28,500	28,500	0	5,100
FY 2009 Recovery Act	65,000	65,000	2,738	0
FY 2010	20,000	20,000	27,423	28,887
FY 2011	36,000	36,000	23,680	38,000
FY 2012	66,000	66,000	10,931	55,000
FY 2013	40,500	40,500	228	55,000
FY 2014	10,500	10,500	0	17,500
FY 2015	0	0	0	2,013
Total, Construction	266,500	266,500	65,000	201,500
TEC				
FY 2006	500	500	0	88
FY 2007	7,000	7,000	0	6,162
FY 2008	13,377	13,377	0	9,108
FY 2009	28,623	28,623	0	10,620
FY 2009 Recovery Act	65,000	65,000	2,738	0
FY 2010	20,000	20,000	27,423	29,009
FY 2011	36,000	36,000	23,680	38,000
FY 2012	66,000	66,000	10,931	55,000
FY 2013	40,500	40,500	228	55,000
FY 2014	10,500	10,500	0	17,500
FY 2015	0	0	0	2,013
Total, TEC	287,500	287,500	65,000	222,500

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[a] The baseline FY 2008 PED funding was reduced by $123,000 as a result of the FY 2008 rescission. This reduction was restored in FY 2009 to maintain the TEC and project scope.

	(dollars in thousands)			
	Appropriations	Obligations	Recovery Act Costs	Costs
Other Project Cost (OPC)				
OPC except D&D				
FY 2004	700	700	0	77
FY 2005	2,300	2,300	0	2,142
FY 2006	4,000	4,000	0	3,508
FY 2007	2,500	2,500	0	2,751
FY 2008	1,000	1,000	0	1,802
FY 2009	0	0	0	155
FY 2010	0	0	0	65
FY 2013	2,500	2,500	0	2,400
FY 2014	7,500	7,500	0	7,000
FY 2015	2,000	2,000	0	2,600
Total, OPC	22,500	22,500	0	22,500
Total Project Cost				
FY 2004	700	700	0	77
FY 2005	2,300	2,300	0	2,142
FY 2006	4,500	4,500	0	3,596
FY 2007	9,500	9,500	0	8,913
FY 2008	14,377	14,377	0	10,910
FY 2009	28,623	28,623	0	10,775
FY 2009 Recovery Act	65,000	65,000	2,738	0
FY 2010	20,000	20,000	27,423	29,074
FY 2011	36,000	36,000	23,680	38,000
FY 2012	66,000	66,000	10,931	55,000
FY 2013	43,000	43,000	228	57,400
FY 2014	18,000	18,000	0	24,500
FY 2015	2,000	2,000	0	4,613
Total, TPC	310,000	310,000	65,000	245,000

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Estimate
Total Estimated Cost (TEC)			
Design (PED)			
Design	21,000	20,150	19,200
Contingency	0	850	1,800
Total, PED (PED no. 06-SC-01)	21,000	21,000	21,000
Construction Phase			
Civil Construction	29,400	29,290	27,450
Accelerator/ Experimental Equipment	175,200	171,810	174,150
Contingency	61,900	65,400	64,900
Total, Construction	266,500	266,500	266,500
Total, TEC	287,500	287,500	287,500
Contingency, TEC	61,900	66,250	66,700
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Design	3,445	3,445	3,500
R&D	7,020	7,020	6,400
Start-up	7,635	7,385	7,450
Contingency	4,400	4,650	5,150
Total, OPC	22,500	22,500	22,500
Contingency, OPC	4,400	4,650	5,150
Total, TPC	310,000	310,000	310,000
Total, Contingency	66,300	70,900	71,850

7. Funding Profile History

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2007 PED only	TEC	19,000	2,000	0	0	0	0	0	0	0	21,000
	OPC	11,000	0	0	0	0	0	0	0	0	11,000
	TPC	30,000	2,000	0	0	0	0	0	0	0	32,000
FY 2008 PED only	TEC	21,000	0	0	0	0	0	0	0	0	21,000
	OPC	10,500	0	0	0	0	0	0	0	0	10,500
	TPC	31,500	0	0	0	0	0	0	0	0	31,500

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2009[a] Performance Baseline	TEC	20,877	28,623	0	59,000	62,000	66,000	40,500	10,500	0	287,500
	OPC	10,500	0	0	0	0	0	2,500	7,500	2,000	22,500
	TPC	31,377	28,623	0	59,000	62,000	66,000	43,000	18,000	2,000	310,000
FY 2010	TEC	20,877	28,623	65,000	22,000	34,000	66,000	40,500	10,500	0	287,500
	OPC	10,500	0	0	0	0	0	2,500	7,500	2,000	22,500
	TPC	31,377	28,623	65,000	22,000	34,000	66,000	43,000	18,000	2,000	310,000
FY 2011	TEC	20,877	28,623	65,000	20,000	36,000	66,000	40,500	10,500	0	287,500
	OPC	10,500	0	0	0	0	0	2,500	7,500	2,000	22,500
	TPC	31,377	28,623	65,000	20,000	36,000	66,000	43,000	18,000	2,000	310,000

8. Related Operation and Maintenance Funding requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	3Q FY 2015
Expected Useful Life (number of years)	15
Expected Future start of D&D for new construction (fiscal quarter)	N/A

(Related Funding requirements)

(dollars in thousands)

	Annual Costs		Life cycle costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Total Project Costs	N/A	N/A	310,000	310,000
Operations	150,000	150,000	2,250,000[b]	2,250,000[a]
Maintenance	Included above	Included above	Included above	Included above
Total, Operations & Maintenance	150,000	150,000	2,560,000	2,560,000

9. Required D&D Information

	Square Feet
Area of new construction	31,500
Area of existing facility(ies) being replaced	N/A
Area of any additional D&D space to meet the "one-for-one" requirement	31,500

The "one-for-one" requirement is met by offsetting 31,500 square feet of the 80,000 square feet of banked space that was granted to Jefferson Laboratory in a Secretarial waiver.

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[a] The FY 2009 Congressional Budget was the first project data sheet to reflect the CD-2 Performance Baseline which was approved in November 2007.

[b] The total operations and maintenance (O&M) is estimated at an average annual cost of ~$150,000,000 (including escalation) over 15 years. Almost 90% of the O&M cost would still have been required had the existing accelerator not been upgraded and instead continued operations at 6 GeV.

10. Acquisition Approach

The Acquisition Strategy was approved in 2Q FY 2006 with CD-1 approval. All acquisitions are managed by Jefferson Science Associates with appropriate Department of Energy oversight. Cost, schedule and technical performance are monitored using an earned-value process that is described in the Jefferson Lab Project Control System Manual. The procurement practice uses firm fixed-price purchase orders and subcontracts for supplies, equipment and services, and makes awards through competitive solicitations. Project and design management, inspection, coordination, tie-ins, testing and checkout witnessing, and acceptance are performed by Jefferson Laboratory and Architectural-Engineering (A-E) subcontractors as appropriate.

Workforce Development for Teachers and Scientists

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Workforce Development for Teachers and Scientists				
Student Programs	5,628	+12,500	13,078	22,700
Educator Programs	6,342	0	5,750	6,400
Program Administration and Evaluation	1,613	0	1,850	6,500
Total, Workforce Development for Teachers and Scientists	13,583	+12,500	20,678	35,600

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act of 1977"
Public Law 101–510, "DOE Science Education Enhancement Act of 1991"
Public Law 103–382, "The Albert Einstein Distinguished Educator Fellowship Act of 1994"
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The mission of the Workforce Development for Teachers and Scientists (WDTS) program is to contribute to the national effort that will ensure that DOE and the Nation have a sustained pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.

Background

DOE and its predecessor organizations have a 60-year history of training and educating scientists, mathematicians, and engineers in the U.S. These highly skilled workers are a key element of the Department's research enterprise and are supported through research grants and contracts at universities, the DOE national laboratories, and the private sector. This commitment to supporting the Nation's scientific and technical workforce has produced tens of thousands of leading scientists, engineers, and technicians who have dedicated their careers to solving national security, energy, and environmental challenges, while pursuing answers to many of the most important scientific questions in physics, chemistry, biology, and other areas of basic science.

DOE's 17 national laboratories provide tremendous opportunities and resources for STEM training and education. The national laboratory system offers a unique learning environment with access to world-class scientists who serve as research mentors to students and access to cutting-edge scientific instrumentation and facilities unavailable at universities or industry. On an annual basis, more than 250,000 K–12 students, 22,000 K–12 educators, 4,000 undergraduate interns, 3,000 graduate students, and 1,600 post-doctoral employees participate in education or training programs at the DOE national laboratories.

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[a] The Recovery Act Appropriation column reflects the allocation of funding as of September 30, 2009.

WDTS leverages the unique capabilities at DOE's national laboratories to sponsor workforce training and education programs that motivate students and educators to pursue careers that will contribute to the Office of Science's mission in discovery science and science for national need. WDTS programs build a sustained pipeline for individuals to pursue STEM fields by rewarding and recognizing students from middle school through graduate school for their participation in science and technology in areas of importance to the Office of Science and to DOE. WDTS has launched the DOE Office of Science Graduate Fellowship Program to support U.S. graduate students pursuing degrees in areas of basic science and engineering important to the DOE mission and increased its support for undergraduate internships.

WDTS encourages the participation of under-represented populations at Minority Serving Institutions (MSIs) and other under-represented institutions through the WDTS Faculty and Student Teams (FaST) and Science Undergraduate Laboratory Internship (SULI) programs. Recruitment for minorities and women is strengthened through the building of partnerships with women and minority-serving scientific professional societies.

Subprograms

WDTS is organized into 3 subprograms: Student Programs, Educator Programs, and Program Administration and Evaluation.

- *Student Programs* focuses on encouraging middle school through graduate students to enter STEM careers and retaining them in the scientific and technical workforce.
- *Educator Programs* focuses on professional development experiences for middle school, high school, community college, and undergraduate educators.
- *Program Administration and Evaluation* develops and deploys evaluation methods for WDTS programs, provides the framework for developing outreach programs to public and private sector organizations, and supports the federal Science of Science Policy (SoSP) initiative.

Benefits

WDTS programs provide students and educators a pathway to STEM careers in scientific disciplines relevant to DOE's mission in energy, environment, national security, and scientific discovery, as well as careers at the Department and its national laboratories. These initiatives benefit society and promote the long-term health of our Nation by improving the STEM content knowledge of U.S. students, increasing the skills and capabilities of STEM educators, and creating a skilled and diverse scientific and technical workforce ready for high-wage job opportunities in emerging technical fields such as sustainable energy production.

WDTS programs provide students with the tools and knowledge needed to make an informed choice about STEM education and career options. Competitions, internships, fellowships, and other activities are designed to introduce students to world class scientific content and research environments. Students engage in science directly tied to societal challenges, such as energy and climate change.

Program Planning and Management

In FY 2010, the WDTS program planning and management activities were restructured to include:

- Rigorous evaluation of all WDTS programs, including a longitudinal workforce study and the development of six leading indicators that drive program improvement efforts: quality, scientific and technical content knowledge, leverage, competition with reward, retention, and diversity.

- Expansion of efforts to provide STEM professional development opportunities for undergraduate faculty as a way to increase the participation of under-represented minorities and women in DOE programs.
- Continued implementation of the DOE Office of Science Graduate Fellowship program in FY 2010–2011 through the addition of a second cohort of Fellows.

WDTS participates on the Education Subcommittee of the National Science and Technology Council (NSTC), which is managed by the White House Office of Science and Technology Policy (OSTP). Through the NSTC subcommittee and other venues, WDTS engages with the National Science Foundation (NSF), National Aeronautics and Space Administration (NASA), Department of Defense (DOD), National Institutes of Health (NIH), and other Federal agencies to develop interagency efforts in science education.

In FY 2010, the WDTS program will be reviewed by a Committee of Visitors (COV). The Basic Energy Sciences Advisory Committee (BESAC) has been charged to commission a COV subcommittee to examine WDTS business processes for their effectiveness and efficiency. The COV will also assess the quality of the WDTS portfolio, including its breadth and depth and national and international standing. The Office of Science conducts COV reviews of major programs every three years to ensure program quality.

Coordination of Education/Workforce Development Activities

WDTS coordinates with other DOE program offices to develop workforce and science education efforts. These efforts leverage existing WDTS capabilities and resources, particularly those developed within the DOE national laboratory system. WDTS has established several programs and supporting infrastructure dedicated to STEM education and workforce efforts (an online application system, outreach efforts, etc.) that have generated interest throughout the agency. As a result, other DOE programs often consult with WDTS as they launch new efforts or propose partnerships that leverage resources.

In FY 2009, WDTS worked with several programs as they developed workforce training and education initiatives. For example, the Office of Energy Efficiency and Renewable Energy (EERE) was encouraged to hire an Einstein Fellow to provide needed educational technical expertise for their efforts; the National Nuclear Security Administration (NNSA) consulted with WDTS as they developed a Faculty and Student Teams effort; and the Office of the Chief Human Capital Officer consulted with WDTS as they developed a STEM outreach effort in California.

In addition, WDTS provides support for K–12 educator professional development and undergraduate internship opportunities at all three NNSA laboratories, the National Renewable Energy Laboratory (EERE), Idaho National Laboratory (Office of Nuclear Energy), and the Savannah River Ecology Laboratory (Office of Environmental Management).

Budget Overview

In FY 2011, WDTS increases funding for the DOE Office of Science Graduate Fellowship program to support a second cohort of students who will pursue advanced science and engineering degrees in fields of basic research relevant to the DOE mission. Fellowships are awarded on a competitive basis and each award is for a period of three years contingent on the Fellow's progress.

Funding in Evaluation Studies is increased in FY 2011 to support the federal Science of Science Policy initiative focused on developing improved data, tools, and methods to assess the effectiveness of investments in science.

WDTS increases funding for the Academies Creating Teacher Scientists (ACTS) as part of an overall strategy to expand research and training opportunities and efforts to provide scientific and technical content to diverse and under-represented populations. Support for the FaST, Community College Institutes (CCI), Outreach, and Workforce Studies programs is also maintained in FY 2011.

Student Programs

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Student Programs			
Science Undergraduate Laboratory Internship	3,009	4,000	4,150
Community College Institute of Science and Technology	266	800	600
Pre-Service Teachers	220	428	450
National Science Bowl®	2,033	2,350	2,100
High School Engineering	0	500	400
DOE Office of Science Graduate Fellowship	100	5,000	15,000
Total, Student Programs	5,628	13,078	22,700

Description

The Student subprogram encourages and enables students from middle school through graduate school to pursue education and training, and ultimately career interests, in science, mathematics, and engineering important to the Office of Science and DOE mission.

Through the National Science Bowl®, WDTS provides experiences to inspire middle and high school students to continue and focus on STEM education and careers. Undergraduate students are provided with mentor-intensive research opportunities at the DOE national laboratories to enhance content knowledge in science and mathematics, while also developing investigative expertise. The DOE Office of Science Graduate Fellowship (DOE SCGF) program sponsors fellowships for talented students pursuing advanced degrees in areas of basic research important to the DOE mission.

Selected FY 2009 Accomplishments

- FY 2009 program evaluation validated that undergraduate research experiences at the DOE national laboratories significantly increased a student's interest in pursuing a STEM career and that their content knowledge in STEM fields of importance to DOE increased as a result of the experience. These evaluation findings confirmed the WDTS approach to STEM workforce development, which relies heavily upon mentored research experiences.
- WDTS sponsored the second annual Science and Energy Research Challenge (SERCh) in November 2009: a rigorous scientific poster competition for undergraduate students participating in DOE research projects at the national laboratories and universities. This competition highlighted the extraordinary quality of research and exposed the faculty at their home institutions to DOE and the research enterprise it supports. One hundred undergraduate students and 45 supporting faculty participated in this competition.
- In FY 2009, WDTS, partnering with the California State University (CSU) system, helped support the CSU "Science Teacher and Researcher" program. This innovative program brings together the long-standing success of the WDTS Pre-Service Teachers program with CSU's emerging K-12 STEM educator professional development program to build a life-long learning and support system

for K-12 educators. Forty pre-service educators supported by CSU participated in the second year of the implementation of the model which, through evaluation, has proven successful in its goals.

- Evaluations performed on 600 scientific abstracts produced by undergraduate students confirm that these WDTS-supported students are participating in highly technical research projects under the close supervision of a senior laboratory scientist. The evaluations also provide a leading indicator that WDTS undergraduate programs are succeeding in their goal of promoting effective mentor/protégé relationships.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Science Undergraduate Laboratory Internship	**3,009**	**4,000**	**4,150**

Science Undergraduate Laboratory Internship (SULI) supports a diverse group of students at DOE's National Laboratories in individually mentored research experiences. Students spend an intensive 10–16 weeks working under the individual mentorship of resident scientists, produce a peer-reviewed abstract and research paper, and attend seminars on science careers and how to become part of the scientific community.

Goals and outcomes are measured based on students' research papers and abstracts, pre- and post-surveys, and an annual evaluation by a group of peers, both within and outside of DOE. An undergraduate student journal is published annually with selected full length peer-reviewed research papers and all abstracts of SULI students. Full research papers published in the journal are presented by the student authors at a poster competition at the annual meeting of the American Association for the Advancement of Science. An annual competition first held in 2008, the Science and Energy Research Challenge (SERCh), recognizes the 15 best posters produced by SULI students through a rigorous and peer reviewed selection process.

In FY 2009, a total of 341 SULI students were supported by WDTS. An additional 35 students were sponsored by NSF. WDTS will support an estimated 570 SULI students in FY 2010 and 590 students in FY 2011. In FY 2010, 100 of these undergraduates will be paired with college faculty as part of the WDTS Faculty and Student Teams (FaST) program. In FY 2011, 120 of these SULI undergraduates will participate in FaST.

Community College Institute of Science and Technology	**266**	**800**	**600**

The Community College Institute (CCI) of Science and Technology, which provides a mentored research internship at a DOE national laboratory for highly motivated community college students, is designed to address DOE's workforce shortages, particularly at the skilled technician level for DOE mission critical areas, such as "green technology" deployment and scientific instrumentation. CCI students spend an intensive 10–16 weeks working under the individual mentorship of resident scientists, produce an abstract and formal research paper, and attend professional enrichment activities, workshops, and seminars on career options and how to become part of the scientific community, and enhance their professional skills.

Goals and outcomes are measured based on students' research papers and abstracts, pre- and post-surveys, and external evaluation. An undergraduate student journal was created to publish selected full research papers and all student abstracts.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

In FY 2009, 52 students directly participated in this internship. Eleven additional students were sponsored by NSF. WDTS will support an estimated 115 CCI students in FY 2010 and 85 students in FY 2011.

Pre-Service Teachers	**220**	**428**	**450**

The Pre-Service Teachers (PST) program, a partnership with NSF, prepares undergraduate students for a K–12 STEM education career. This effort addresses the national need to improve the content knowledge of STEM educators prior to entering the teaching workforce and to improve the retention rate of those educators once they enter the field (which has a 50% dropout rate during the first five years). Students spend an intensive 10 weeks working under the mentorship of a master teacher and a DOE laboratory scientist to help maximize the building of content knowledge and skills through the research experience. They also produce an abstract and educational module related to their research; an optional research paper, poster, or oral presentation; and attend professional enrichment activities, workshops, and seminars that help students apply what they learn to their academic program and the classroom. Goals and outcomes are measured based on students' abstracts, education modules, pre- and post-surveys, and external evaluation.

In FY 2009, 6 DOE national laboratories hosted 29 participating students. In FY 2010, WDTS funding supports 60 students and 7 master teachers at 7 DOE national laboratories. In FY 2011, the increase in funding will support 63 students and 7 master teachers at 7 DOE national laboratories.

National Science Bowl®	**2,033**	**2,350**	**2,100**

The National Science Bowl® is an internationally recognized, prestigious academic event for high school and middle school students. It has attained its level of recognition and participation through a grass-roots design, and encourages the voluntary participation of more than 7,000 professional scientists, engineers, and educators from across the Nation. Students answer questions on topics in astronomy, biology, chemistry, mathematics, and physics in a highly competitive, Jeopardy®-style format.

In its 20-year history (1991–2010), more than 250,000 students from across the Nation have participated in regional and national competitions and have been encouraged to pursue careers in mathematics and science. The National Science Bowl® provides students and educators with a forum to receive recognition for their talent and hard work by solving academic problems in selected fields of science and math, in addition to their participation in various hands-on science challenges. In 2011, both the high school and middle school teams that win their regional events will attend the four-day national finals held in Washington, D.C. During this time, the students participate in a day of scientific seminars and science discovery activities with the students "doing" science, with the event culminating in an academic competition. Middle school teams participate in the model hydrogen fuel cell car competition. WDTS funding provides all of the travel and lodging expenses for each winning team attending the national event, seminar speakers, trophies, awards, and equipment for the various hands-on and interactive science activities and events.

The number of regional events remains relatively constant from one year to the next with 67 to 70 high school and 36 to 40 middle school teams participating in the national competition in recent years. About 22,000 middle and high school students participate at the regional and national competitions each year, along with more than 7,000 coaches and volunteers.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
High School Engineering	**0**	**500**	**400**

The High School Engineering activity (formerly the Real World Design Challenge [RWDC]) originated out of the National Science Bowl® high school engineering competition. The National Science Bowl® focuses on basic research knowledge, but for 5 years high school students also participated in an engineering challenge (typically a model fuel cell car event) as part of the competition. In FY 2010, WDTS is reviewing options to determine the most effective way to promote engineering education at the high school level, focusing on the sciences and technologies sponsored by DOE. Emphasis will be made on increasing under-represented population participation.

DOE Office of Science Graduate Fellowship	**100**	**5,000**	**15,000**

WDTS is implementing the DOE Office of Science Graduate Fellowship (DOE SCGF) program in FY 2010 with an initial cohort of approximately 160 graduate students. Approximately 80 graduate student fellowships are being supported through funding provided by the Recovery Act, and an additional 80 students are being supported by FY 2010 appropriated funds. The goal of the Fellowship is to encourage talented students to pursue research-focused graduate studies in physics, chemistry, biology, mathematics, computer science, engineering, and environmental science—areas of basic research important to the DOE mission. Applicants must be U.S. citizens pursing graduate studies at a U.S. accredited college or university. Awards are competitively selected on the basis of merit review of applications against established merit review criteria. The Fellowship provides up to three years of support for a graduate student, including a stipend for tuition and fees, an annual stipend for living expenses, and a research stipend that can be used for costs associated with the student's research and for travel to conferences and DOE scientific user facilities.

Program evaluation will include pre- and post-surveys of students, as well as longitudinal studies that determine whether students continue to pursue careers in scientific and technical fields. The FY 2011 funding will support a new cohort of 170 graduate fellows, creating a total of two cohorts (including fellows supported by Recovery Act funding) of 330 fellows.

Total, Student Programs	**5,628**	**13,078**	**22,700**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Science Undergraduate Laboratory Internship	
The number of students participating in this program increases by 20 in FY 2011, from 570 in FY 2010 to a total of 590 in FY 2011.	+150
Community College Institute of Science and Technology	
The number of students participating in this program decreases by 30 from 115 in FY 2010 to 85 in FY 2011.	-200

	FY 2011 vs. FY 2010 ($000)
Pre-Service Teachers	
The number of students participating in this program increases by 3 in FY 2011, from 60 in FY 2010 to 63 students.	+22
National Science Bowl®	
Support is decreased due to lower costs associated with kits needed for the middle school solar car competition.	-250
High School Engineering	
Support is decreased due to a restructuring of WDTS support for the former Real World Design Challenge activity.	-100
DOE Office of Science Graduate Fellowship	
A new cohort of 170 Fellows will be funded in FY 2011, joining the first cohort of 80 from FY 2010 and 80 supported by the Recovery Act.	+10,000
Total Funding Change, Student Programs	**+9,622**

Educator Programs

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Educator Programs			
Academies Creating Teacher Scientists	4,130	3,750	4,200
Faculty and Student Teams	1,212	1,000	1,200
Albert Einstein Distinguished Educator Fellowship	1,000	1,000	1,000
Total, Educator Programs	6,342	5,750	6,400

Description

Improving the ability of educators at all levels to serve as mentors and teach science content is one of the most effective ways to increase the size and quality of the STEM workforce. Mentored laboratory research experiences are an effective approach to meet this goal. WDTS has built programs at the K–12 and undergraduate levels that focus on increasing educator knowledge of DOE science and technology content, programs and missions, providing them with the resources that enable them to be successful in the classroom. The Academies Creating Teacher Scientists (ACTS) program is the platform from which WDTS launches its long-term relationships with K–12 educators. The Faculty and Student Teams (FaST) program is WDTS's premier mechanism to bring under-represented faculty and students into the mainstream of DOE's research enterprise. The Albert Einstein Distinguished Educator Fellowship benefits Federal agencies and Congressional offices because these outstanding educators provide their real-world classroom expertise and advice to national policy makers.

Selected FY 2009 Accomplishments

- ACTS participants in FY 2009 reported in evaluation surveys that their content knowledge in physics, chemistry, and geophysics increased by more than 20%, on average: a key indicator that the program is succeeding in embedding key science content into K–12 classrooms.
- In FY 2009, WDTS significantly increased support for students and faculty through the FaST program, enabling an additional 30 faculty and 120 students from under-represented institutions to participate in mentored research projects at DOE national laboratories. Faculty and students reported in evaluation surveys that their scientific content knowledge, ability to conduct research, and understanding of how to pursue a research career increased as a result of the FaST experience.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Academies Creating Teacher Scientists	**4,130**	**3,750**	**4,200**

ACTS requires a 3-year commitment by educators to participate in this program. Each educator spends an intensive 4–8 weeks annually at DOE national laboratories working under the mentorship of master educators and laboratory scientists to build content knowledge, research skills, and a lasting connection with the scientific community through the research experience. Master educators, who are expert K–12

(dollars in thousands)	FY 2009	FY 2010	FY 2011

educators and adept in both scientific research and scientific writing, act as liaisons between the mentor scientists and the educator participants. This helps the educators transfer the research experiences to their classrooms. Participants receive an $800 per week stipend plus travel and housing expenses while at DOE national laboratories.

The program includes self-identification of science content gaps by the educator participant, pre- and post-surveys that benchmark the progress of each participant, and a requirement for successful development of a professional development plan by each educator. Program impact is determined through review of the surveys and development plans, national laboratory self-appraisals, evaluation of impact on local STEM education and student achievement, and the ultimate retention of the educators in STEM K–12 education.

DOE ACTS funded 229 educators in FY 2009 and will fund 212 educators (140 continuing and 72 new) and 14 master teachers in FY 2010. The FY 2011 request funds a total of 238 educators (212 continuing and 26 new) and provides master teachers at each participating laboratory.

	FY 2009	FY 2010	FY 2011
Faculty and Student Teams	**1,212**	**1,000**	**1,200**

Faculty and Student Teams (FaST) provides an opportunity for faculty and students from under-represented colleges and universities to work on a mentor-intensive science research project at a DOE national laboratory. Faculty members are encouraged to return to the laboratory in subsequent summer terms. The program has two key components: faculty professional development designed to encourage faculty with limited research experience to develop grant proposals and participate in DOE research programs and student cohorts who accompany the faculty member and participate in a mentored research effort. FaST activities at DOE national laboratories are also being conducted in collaboration with the NSF.

Surveys and other evaluation studies have revealed that faculty support of students at the DOE national laboratories is particularly important for Minority Serving Institutions (MSIs), which are primarily teaching institutions and generally do not have the ability to support research activities at their home institutions. The FaST program enables the MSIs to build faculty research capabilities, encourages cohorts of diverse students to participate in DOE research, and improves the retention and recruitment of under-represented populations in the DOE system.

Beginning in FY 2010, all of the undergraduate students participating in FaST are supported on FaST teams will instead be supported through the SULI and CCI programs. The FaST budget request supports faculty participation. WDTS will support 50 faculty in FY 2010 and will support at least 60 faculty in FY 2011.

	FY 2009	FY 2010	FY 2011
Albert Einstein Distinguished Educator Fellowship	**1,000**	**1,000**	**1,000**

The Albert Einstein Distinguished Educator Fellowship for K–12 STEM educators brings classroom and education expertise to Congress, DOE, and other Federal agencies' education and outreach activities. These educators provide practical insights and real-world perspectives to policy makers and program managers. The Einstein Fellowship is also a valuable professional development opportunity for the educators because they return to the education field with knowledge of Federal programs and resources and an improved understanding of national education policies.

WDTS manages the Einstein Fellowship on behalf of the Federal government and encourages participation by other Federal agencies. In FY 2010, a total of 23 fellows participated in the program:

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
3 fellows at DOE, 4 in Congress, and 16 at other Federal agencies, including NSF, NASA, NOAA, and NIH. Of these, 6 were directly supported by WDTS.			
Evaluation of the Einstein Fellowship program is conducted through longitudinal surveys of past participants, surveys of current participants, and reviews by external experts.			
The FY 2011, WDTS request will directly support 6 fellows. The funding will also augment stipends and health insurance for the participants.			
Total, Educator Programs	**6,342**	**5,750**	**6,400**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Academies Creating Teacher Scientists	
The number of educators participating in DOE ACTS increases by 26 in FY 2011, from 212 in FY 2010 to 238.	+450
Faculty and Student Teams	
The number of faculty supported by DOE increases by 10 in FY 2011, from 50 in FY 2010 to 60 in FY 2011.	+200
Total Funding Change, Educator Programs	**+650**

Program Administration and Evaluation

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Program Administration and Evaluation			
Laboratory Equipment Donation Program	75	240	200
Evaluation Studies	220	200	5,200
Technology Development and On-Line Application	441	400	300
Outreach	302	610	400
Workforce Studies	575	300	300
Mentor Program	0	100	100
Total, Program Administration and Evaluation	1,613	1,850	6,500

Description

The Program Administration and Evaluation subprogram provides the data, analysis, and other resources required for effective WDTS program management and delivery. Analytical/evaluation studies are used to ensure the efficiency and effectiveness of WDTS programs. Non-financial resources, such as laboratory equipment and on-line applications, enable WDTS performers and participants to effectively participate in WDTS programs. In addition, WDTS has initiated a number of outreach efforts with universities, professional societies, the private sector, and other Federal agencies designed to fully leverage the WDTS investment in workforce development and STEM education programs.

Selected FY 2009 Accomplishments

- WDTS developed a consistent evaluation effort in FY 2009 that aligned programmatic goals to 6 leading indicators of success (retention, diversity, quality, content knowledge, competition with reward, and leveraging) and enabled WDTS to set uniform expectations for program management and success. A rigorous review process of undergraduate research abstracts was undertaken in FY 2009 that revealed inconsistencies in program management of the flagship SULI program and led to program changes, such as new scoring rubric for scientific abstracts, to improve the overall quality of the abstracts and effectiveness of the SULI, CCI, and PST programs.
- WDTS implemented a competitive solicitation process in FY 2009 for all of WDTS's DOE national laboratory-based programs, linked to WDTS's 6 leading indicators and overall evaluation processes. The result is an allocation of WDTS resources in FY 2010 that will be tied to program effectiveness at the DOE National Laboratories.
- In FY 2009, WDTS, in partnership with the DOE Office of Scientific and Technical Information (OSTI), successfully piloted the *ScienceEducation.gov* web portal, which provides a single location for students and faculty to identify content, experiments and other materials that originate from WDTS and the DOE national laboratories. The new website utilizes "web 2.0" technology to identify best practices based on community views and also utilizes a sophisticated new search protocol that enables students and educators to identify content by grade level based on state standards.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Laboratory Equipment Donation Program	**75**	**240**	**200**

The Laboratory Equipment Donation Program provides excess equipment to faculty at institutions of higher education for energy-related research. Through the Energy Asset Disposal System, DOE sites identify excess laboratory equipment. Colleges and universities can search for equipment of interest to them and apply via the website. DOE property managers approve or disapprove the applications. The equipment is free, but the receiving institution pays for shipping costs. In FY 2009, more than 400 individual pieces of surplus scientific equipment from DOE national laboratories with an original value of more than $9,000,000 were donated to U.S. universities through the Laboratory Equipment Donation Program.

WDTS expanded this program in FY 2010 to middle schools and high schools and will pay for shipping costs to those institutions.

Evaluation Studies	**220**	**200**	**5,200**

In FY 2011, the Office of Science will initiate a research program to assess the effectiveness of investments in science, consistent with the federal interagency Science of Science Policy (SoSP) initiative. The Office of Science has worked closely with the Office of Science and Technology Policy, the National Science Foundation and other Federal agencies in the development of the SoSP effort, including the development of *The Science of Science Policy: A Federal Research Roadmap*, published in November 2008, and partnering in several community workshops. Research awards in FY 2011 will be competitively awarded on the basis of peer review.

Technology Development and On-Line Application	**441**	**400**	**300**

Technology Development and Online-Application Systems provides for a new IT architecture, which is a 3-year endeavor, to enhance and maintain the WDTS application and electronic portfolio system. Funding in FY 2011 will support the third year of the new design of all of the websites, on-line applications, DOE ACTS education portfolios, Graduate Fellowship, and pre- and post-surveys that participants complete during their internship/fellowship experiences.

Outreach	**302**	**610**	**400**

Outreach provides information to WDTS program alumni (from competitions, undergraduate research internships, educator programs, etc.) to encourage their continued participation in WDTS programs; creates a common database of internship opportunities, fellowships, and other research-based educational opportunities offered by WDTS; assists in the coordination of outreach activities with other Federal agencies; and enhances communication about WDTS programs to the public. A major emphasis of the outreach effort is to increase the participation of under-represented groups and institutions in WDTS programs. WDTS has established relationships with major associations representing under-represented groups and has been working with other Federal agencies, including NSF, to develop cooperative programs that leverage WDTS funds. This enables WDTS to maintain outreach efforts despite reduced funding.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Workforce Studies	**575**	**300**	**300**

Workforce Studies focus on the critical skill gaps, by scientific discipline, which may exist within the Office of Science Federal and national laboratory workforces. These studies are designed to be long-term sustained efforts that provide a baseline of data to effectively manage WDTS programs and set overall strategic direction. Full implementation in FY 2009–2010 will provide in-depth and systematic reviews of workforce requirements and help determine the long-term benefits of WDTS program investments by tracking the progress of STEM students and workers who participate in WDTS programs.

	FY 2009	FY 2010	FY 2011
Mentor Program	**0**	**100**	**100**

The Mentor Program is implemented in FY 2010 and has two components: a professional development effort designed to recruit and train mentor scientists at DOE national laboratories and a recognition/rewards program that will provide incentives for mentor participation in WDTS programs. Scientist mentors are the key resource for WDTS programs and must be nurtured in a systematic manner to ensure a sufficient supply of mentors.

	FY 2009	FY 2010	FY 2011
Total, Program Administration and Evaluation	**1,613**	**1,850**	**6,500**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Laboratory Equipment Donation Program	
FY 2010 included a one-time increase to expand the program to high-need middle and high schools.	-40
Evaluation Studies	
Increased funding supports participation in the federal interagency Science of Science Policy initiative.	+5,000
Technology Development and On-Line Application	
A major development effort for WDTS on-line technologies occurred from FY 2009–2010 and will be completed in FY 2011. Funding reflects the level of development activity needed to complete the project and sustain the WDTS technology investments.	-100
Outreach	
Cooperative programs with other federal agencies leverage WDTS funding.	-210
Total Funding Change, Program Administration and Evaluation	**+4,650**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	13,583	20,678	35,600

Science Laboratories Infrastructure

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Science Laboratories Infrastructure				
Infrastructure Support	31,308	+103,873	6,599	6,645
Construction	114,072	+94,241	121,001	119,355
Total, Science Laboratories Infrastructure	145,380	+198,114	127,600	126,000

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The Science Laboratories Infrastructure (SLI) program mission is to support scientific and technological innovation at the Office of Science (SC) laboratories by funding and supporting mission-ready infrastructure and fostering safe and environmentally responsible operations. Paramount among these is the provision of infrastructure necessary to ensure world leadership by the SC national laboratories in the area of basic scientific research now and in the future. SLI also supports SC stewardship responsibilities for the Oak Ridge Reservation and the Federal facilities in the city of Oak Ridge, and provides Payments in Lieu of Taxes to local communities around the Argonne, Brookhaven, and Oak Ridge National Laboratories.

Background

In FY 2009, SC began an initiative to revitalize SC laboratories over ten years, with the goal of providing the modern laboratory infrastructure needed to deliver the advances in science the Nation requires to remain competitive in the 21st century. Through this initiative, SC is ensuring that SC laboratories have state-of-the-art facilities and utilities that are flexible, reliable, and sustainable, with environmentally stable research space and high performance computing space needed to support scientific discovery. New and renovated buildings and utilities will include the latest temperature and humidity controls, clean power, and isolation from vibration and electromagnetic interference where needed. Facility designs will ensure collaborative and interactive work environments and allow for the integration of basic and applied research and development. Once modernized, SC infrastructure will also aid in the recruitment and retention of the "best and brightest" to work at world-class laboratories.

Despite past investments in infrastructure, many SC laboratory facilities and utility systems are not adequate to support the scientific mission because they do not meet the requirements of modern research described above. The Infrastructure Modernization Initiative will provide capital investment through the SLI program to make these needed improvements. The goals of the Infrastructure Modernization Initiative are to:

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

- Provide the modern laboratory infrastructure needed to deliver advances in science the Nation requires to remain competitive in the 21st century, and
- Correct longstanding deficiencies while ensuring laboratory infrastructure provides a safe and quality workplace.

The Infrastructure Modernization Initiative currently includes a portfolio of approximately 35 projects across all ten SC laboratories that will provide modern laboratory space, renovate space that does not meet research needs, replace facilities that are no longer cost effective to renovate or operate, modernize utility systems to prevent failures and ensure efficiency, and/or remove excess facilities to allow safe and efficient operations. The completion of these projects is critical to ensuring the continued mission readiness of SC laboratories. Mission readiness of a laboratory's facilities and infrastructure is the capability of those assets to effectively support the scientific mission assigned to the laboratory. The current and future mission readiness of each SC laboratory is evaluated using a peer-reviewed process which focuses on the ability of each laboratory infrastructure element to meet the needs of scientific research.

To execute and manage the Infrastructure Modernization Initiative effectively, the SLI program uses the SC Annual Laboratory Plans. The Annual Laboratory Plans integrate scientific planning with infrastructure and operational planning by directly tying proposed investments to identified mission capability gaps. The plans provide a clear picture of the mission readiness of each laboratory, the capability gaps, and the investments necessary to fill those gaps. The investments proposed form the basis for projects included in the Initiative.

Subprograms

The first subprogram of the SLI budget, Infrastructure Support, provides operating funds for the cleanup and removal of excess facilities at SC laboratories and for SC stewardship and Payment in Lieu of Taxes responsibilities. The second subprogram, Construction, includes construction projects under the Infrastructure Modernization Initiative.

Benefits

The modern, safe, and environmentally-friendly laboratories provided by the SLI program will facilitate break-through discoveries for America's future. Accelerated demolition of inadequate facilities, including the Bevatron at Lawrence Berkeley National Laboratory, will remove safety and environmental hazards. Construction creates jobs that will benefit the manufacturing, transportation (freight), and construction industries. Subsequent research and development in these revitalized facilities will facilitate discovery of new technologies, expected to result in long-term economic growth and job creation in the American economy.

Budget Overview

The primary focus of the SLI budget is the ongoing Infrastructure Modernization. Ongoing line-item projects are continued and two new projects are initiated. Funding for Excess Facilities Disposition (EFD) projects other than the Bevatron was discontinued in FY 2009 because projects funded under the Infrastructure Modernization Initiative will, in many cases, include funds for removal of aged and outdated facilities that are being replaced by new ones. Other small facility decontamination and decommissioning and cleanup projects not included in the Infrastructure Modernization Initiative will be funded with laboratory overhead. With final funding of the Bevatron in FY 2009 under the Recovery Act, funding for the EFD activity has been discontinued in FY 2010.

Infrastructure Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Infrastructure Support			
Excess Facilities Disposition	24,844	0	0
Oak Ridge Landlord	5,079	5,214	5,260
Payments in Lieu of Taxes	1,385	1,385	1,385
Total, Infrastructure Support	31,308	6,599	6,645

Description

The Infrastructure Support subprogram provides SC stewardship responsibilities for the Oak Ridge Reservation and the Federal facilities in the city of Oak Ridge, and Payments in Lieu of Taxes (PILT) to local communities around the Argonne, Brookhaven, and Oak Ridge National Laboratories. In the past, the subprogram provided operating funds for the cleanup and removal of excess facilities at SC laboratories.

Selected FY 2009 Accomplishments

- *Continued demolition of the Building 51 and Bevatron Demolition Project at Lawrence Berkeley National Laboratory.* The project is eliminating a legacy accelerator which ceased operation in 1993, freeing up approximately three acres of much needed land at the site for programmatic use. In FY 2008, the contract for this demolition project was awarded significantly below project estimates and demolition was started. In FY 2009, the project completed isolation of utility systems feeding the structures to be demolished, removed hazardous materials (asbestos, lead dust, and depleted uranium), decontaminated surface radioactive materials present in the facility, and began removal and disposal of shielding blocks (about 13,000 tons of concrete).

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Excess Facilities Disposition (EFD)	**24,844**	**0**	**0**

Final funding for the Building 51 and Bevatron Demolition Project was provided in FY 2009. Cleanup and removal of future excess facilities at SC sites will be funded by laboratory overhead, via line-item construction projects, or by the Office of Environmental Management.

Oak Ridge Landlord	**5,079**	**5,214**	**5,260**

This funding supports landlord responsibilities, including infrastructure for the 24,000 acres of the Oak Ridge Reservation outside of the Y-12 plant, ORNL and the East Tennessee Technology Park, and DOE facilities in the city of Oak Ridge. Supported activities include maintenance of roads, grounds and other infrastructure, support and improvement of environmental protection, safety and health, PILT to Oak Ridge communities, and other needs related to landlord responsibilities. These activities

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

maintain continuity of operations at the Oak Ridge Reservation and the DOE facilities in Oak Ridge and minimize interruptions due to infrastructure or other systems failures.

	FY 2009	FY 2010	FY 2011
Payments in Lieu of Taxes (PILT)	**1,385**	**1,385**	**1,385**

Provides PILT to support assistance requirements for communities around the Argonne and Brookhaven National Laboratories. PILT payments are negotiated between the Department and local governments based on land values and tax rates.

	FY 2009	FY 2010	FY 2011
Total, Infrastructure Support	**31,308**	**6,599**	**6,645**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Oak Ridge Landlord	
Increase to support reservation road repairs and other critical maintenance needs.	+46
Total Funding Changes, Infrastructure Support	**+46**

Construction

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Construction			
Utilities Upgrade at FNAL (11-SC-70)	0	0	7,524
Utility Infrastructure Modernization at TJNAF (11-SC-71)	0	0	7,828
Research Support Building and Infrastructure Modernization at SLAC (10-SC-70)	0	6,900	33,100
Energy Sciences Building at ANL (10-SC-71)	0	8,000	15,000
Renovate Science Laboratories, Phase II, at BNL (10-SC-72)	0	5,000	15,000
Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, at LBNL (09-SC-72)	12,495	34,027	20,103
Interdisciplinary Science Building, Phase I, at BNL (09-SC-73)	8,240	39,387	0
Technology and Engineering Development Facility at TJNAF (09-SC-74)	3,700	27,687	20,800
Modernization of Laboratory Facilities at ORNL (08-SC-71)	25,103	0	0
Physical Sciences Facility at PNNL (07-SC-05)	52,775	0	0
Science Laboratories Infrastructure Project (MEL-001)	11,759	0	0
Total, Construction	114,072	121,001	119,355

Description

The SLI Construction subprogram funds line item construction projects to maintain and enhance the general purpose infrastructure at SC laboratories. Projects are selected using a collaborative approach involving SC Site Office Managers, laboratory Chief Operating Officers, and the SC Deputy Directors for Field Operations and Science Programs. Input is also solicited from the SC research program Associate Directors. Infrastructure Modernization Initiative investments are included in this subprogram and are focused on the accomplishment of long-term science goals and strategies at each SC laboratory.

Selected FY 2009 Accomplishments

- Significant progress was made on construction of the Physical Sciences Facility (PSF) at Pacific Northwest National Laboratory (PNNL). This project is necessary to ensure continued research capabilities at this laboratory as existing space is cleaned up and demolished by the Office of Environmental Management. In FY 2009, erection of structural steel and enclosure of the major new facilities was completed along with substantial progress on interior plumbing, HVAC, and electrical systems. The Documented Safety Analysis for the 325 Building, a category 2 nuclear facility that will be retained for continued use, was updated and the Safety Evaluation Report was approved. Safety performance on this project has been good, and the project is on track to meet its cost and schedule milestones.

- Construction began on a new chemical and materials science laboratory building at ORNL funded by the Modernization of Laboratory Facilities project. Construction is proceeding consistent with the project's cost and schedule baseline.
- A performance baseline for the renovation portion of the Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II project at LBNL was established. The project received approval to start early demolition work in the existing Life Sciences building in preparation for modernizing this facility.
- Site preparation began in support of construction of the new Interdisciplinary Science Building at BNL.
- Three additional projects in the Infrastructure Modernization Initiative achieved approval of Critical Decision-1, Approve Alternative Selection and Cost Range. These projects will construct a new Research Support Building and renovate critical existing facilities at SLAC National Accelerator Laboratory, construct a new Energy Sciences Building at Argonne National Laboratory, and modernize the Physics and Chemistry buildings at Brookhaven National Laboratory.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Utilities Upgrade at FNAL (11-SC-70)	**0**	**0**	**7,524**

This project will upgrade the laboratory's industrial cooling water system and the high voltage electrical system. Both of these systems are critical for the current and future mission at the laboratory. System components are at the end of their design life and replacement parts are no longer available. FY 2011 funding will be used for Project Engineering and Design activities and to commence construction, including project management and associated support functions.

Utility Infrastructure Modernization at TJNAF (11-SC-71)	**0**	**0**	**7,828**

At TJNAF, the accelerator science core capability has an immediate need for investment to ensure the laboratory utilities infrastructure can continue to support the superconducting radio frequency mission in the research, development, and production of cryomodules. The project scope will include upgrades to the power distribution, cooling water, and communications systems. FY 2011 funding will be used for Project Engineering and Design activities and to commence construction, including project management and associated support functions.

Research Support Building and Infrastructure Modernization at SLAC (10-SC-70)	**0**	**6,900**	**33,100**

SLAC National Accelerator Laboratory has evolved from a single program to a multi-program laboratory. This transition, combined with the condition and age of SLAC facilities drives the need to consolidate core research groups and modernize key support buildings. The Research Support Building and Infrastructure Modernization project will replace substandard modular buildings and trailers that are well beyond their intended useful life with a new Research Support Building and will also modernize existing buildings onsite. FY 2010 funding is being used for Project Engineering and Design activities. FY 2011 construction funding will be used to commence construction activities, including project management and associated support functions.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Energy Sciences Building at ANL (10-SC-71)	**0**	**8,000**	**15,000**

Argonne National Laboratory research capabilities are currently hampered by antiquated, scientifically inadequate, and inefficient research space. This project will provide environmentally stable, specialized, and flexible space by constructing the new Energy Sciences Building to replace some of the oldest and least effective research space for energy-related sciences. FY 2010 funding is being used for Project Engineering and Design activities. FY 2011 construction funding will be used to commence construction activities, including project management and associated support functions.

Renovate Science Laboratories, Phase II, at BNL (10-SC-72)	**0**	**5,000**	**15,000**

A large number of scientists and researchers at Brookhaven National Laboratory are conducting science in laboratories built over forty years ago. Two such buildings are Building 510 (Physics) and Building 555 (Chemistry). Although their basic building core and shell construction is sound, the lab and office spaces and their utilities and environmental support systems are obsolete. This project will modernize unsuitable laboratory space in these two buildings, allowing them to continue supporting research in Basic Energy Sciences and Nuclear and High Energy Physics. FY 2010 funding is being used for Project Engineering and Design activities. FY 2011 construction funding will be used to commence construction activities, including project management and associated support functions.

Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, at LBNL (09-SC-72)	**12,495**	**34,027**	**20,103**

Lawrence Berkeley National Laboratory is located near the Hayward Fault. Recent building evaluations identified more than 30 buildings that would not survive a major earthquake without significant damage to the structure and appreciable life safety hazard to their occupants. This project will remedy high seismic life-safety risks by replacing seismically-poor buildings and trailers with a new general purpose laboratory/office building supporting Life Sciences. This project will also seismically upgrade the site-wide Hazardous Waste Handling Facility and modernize an existing Life Sciences building (Building 74). FY 2009 original and Recovery Act funding supported Project Engineering and Design activities, as well as early procurements and construction work. FY 2010 funds are being used for construction activities, project management, and support functions. FY 2011 funds will be used to continue construction activities, including project management and all associated support functions.

Interdisciplinary Science Building, Phase I, at BNL (09-SC-73)	**8,240**	**39,387**	**0**

This project at Brookhaven National Laboratory will provide high accuracy laboratories (e.g., equipped with precise temperature, humidity, and vibration controls), offices, and support space for energy-related research and development in a new interdisciplinary facility. It is part of a broader modernization plan for the laboratory that includes construction of new facilities where capabilities cannot be incorporated into existing buildings or where extensive life-extension work is not cost efficient, and renovation of existing building and utilities where the infrastructure can be made conducive to meet mission needs. This project includes demolition of offsetting space. FY 2009 original and Recovery Act funding supported Project Engineering and Design and early construction activities.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

FY 2010 funding for this project is being used to complete construction of the building, including project management and all associated support functions.

	FY 2009	FY 2010	FY 2011
Technology and Engineering Development Facility at TJNAF (09-SC-74)	**3,700**	**27,687**	**20,800**

The Technology and Engineering Development Facility project will ensure TJNAF facilities can reliably support production of advanced cryomodules with the quality required for ongoing and future projects and sustain the current high demand for mounting numerous unique large-scale particle detectors. It includes construction of new industrial assembly, laboratory, and office space to eliminate overcrowding and improve workflow and productivity by co-locating the engineering and technical functions currently spread across the laboratory. This project will also renovate existing space in the Test Lab Building, to provide efficient workflow, a safe and sustainable work environment, and functional efficiencies. Demolition of inadequate and obsolete work space is also included. FY 2009 funding was used for Project Engineering and Design activities. FY 2010 and FY 2011 funds will be used to commence and continue construction work, including project management and associated support activities.

	FY 2009	FY 2010	FY 2011
Modernization of Laboratory Facilities at ORNL (08-SC-71)	**25,103**	**0**	**0**

Science operations of research groups housed in the ORNL 4500 Complex are affected by the functionality of the old, deteriorating building facilities. This project is constructing a new chemical and materials science laboratory building to support research activities currently housed in the 4500 Complex. The project will provide modern, 21st-century research laboratories, with associated space for offices, small-group conference rooms, and support functions. The FY 2009 original and Recovery Act funding for this project was used to complete construction of the building, including project management and all associated support functions. The project is on track to meet is performance baseline milestones, which include project completion in FY 2012.

	FY 2009	FY 2010	FY 2011
Physical Sciences Facility at PNNL (07-SC-05)	**52,775**	**0**	**0**

This project is for the construction of new laboratory and office space on the PNNL site north of Horn Rapids Road and completion of life extension upgrades to the 325 Building to accommodate a portion of the existing research capabilities displaced as a result of the closure and cleanup of facilities in the Hanford 300 Area. The FY 2009 appropriation completed funding of the DOE portion of this project and is being used to continue project construction activities as well as facility start-up and readiness activities. The project is on track to meet its performance baseline milestones, which include project completion in FY 2011.

	FY 2009	FY 2010	FY 2011
Science Laboratories Infrastructure Project (MEL-001)	**11,759**	**0**	**0**
▪ **OSTI Facility Improvements (MEL-001-052)**	**2,500**	**0**	**0**

The subproject provides critical roof replacement and upgrade of the fire safety protection system at the Office of Scientific and Technical Information (OSTI) facility in Oak Ridge, Tennessee housing DOE's historic and current paper and electronic collection of energy-related R&D results.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
- **Renovate Science Laboratory, Phase I, at BNL (MEL-001-050)**	**6,642**	**0**	**0**
This subproject upgrades and rehabilitates existing obsolete and unsuitable laboratory facilities in Building 480 (Material Science Building) and Building 815 (Multi-Program Laboratory/Office building) into modern, efficient facilities compatible with world-class scientific research.			
- **Seismic Safety Upgrade of Buildings, Phase I, at LBNL (MEL-001-047)**	**2,617**	**0**	**0**
This subproject addresses the seismic vulnerability of laboratory buildings where high life-safety risks have been identified in Building 50 (Main Office Building) and Building 74 (Life Sciences).			
Total, Construction	**114,072**	**121,001**	**119,355**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Utilities Upgrade at FNAL (11-SC-70)	
Project Engineering and Design and early construction activities are initiated.	+7,524
Utility Infrastructure Modernization at TJNAF (11-SC-71)	
Project Engineering and Design and early construction activities are initiated.	+7,828
Research Support Building and Infrastructure Modernization at SLAC (10-SC-70)	
Increased project funding per the preliminary Project Execution Plan.	+26,200
Energy Sciences Building at ANL (10-SC-71)	
Increased project funding per the preliminary Project Execution Plan.	+7,000
Renovate Science Laboratories, Phase II, at BNL (10-SC-72)	
Increased project funding per the preliminary Project Execution Plan.	+10,000
Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, at LBNL (09-SC-72)	
Decreased project funding per the preliminary Project Execution Plan.	-13,924
Interdisciplinary Science Building, Phase I, at BNL (09-SC-73)	
Funding was provided in FY 2010 to complete the project profile.	-39,387
Technology and Engineering Development Facility at TJNAF (09-SC-74)	
Decreased project funding per the preliminary Project Execution Plan.	-6,887
Total Funding Change, Construction	**-1,646**

Supporting Information

Operating Expenses, Capital Equipment, and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	31,208	6,499	6,545
General Plant Projects	100	100	100
Construction	114,072	121,001	119,355
Total, Science Laboratories Infrastructure	145,380	127,600	126,000

Construction Projects

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act[a]	FY 2010	FY 2011	Outyears	Total
Utilities Upgrade at FNAL (11-SC-70)							
TEC	0	0	0	0	7,524	TBD	31,300–34,900
OPC[b]	0	0	0	1,100	0	0	1,100
TPC	0	0	0	1,100	7,524	TBD	32,400–36,000[c]
Utility Infrastructure Modernization at TJNAF (11-SC-71)							
TEC	0	0	0	0	7,828	TBD	24,300–29,200
OPC[b]	0	0	0	650	0	0	650
TPC	0	0	0	650	7,828	TBD	24,950–29,850[c]
Research Support Building and Infrastructure Modernization at SLAC (10-SC-70)							
TEC	0	0	0	6,900	33,100	TBD	80,000-96,000
OPC[b]	0	700	0	100	100	500	1,400
TPC	0	700	0	7,000	33,200	TBD	81,400–97,400[c]

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[a] The Recovery Act column reflects the planned allocation of funding from the American Recovery and Reinvestment Act of 2009, P.L. 111–5. See the Department of Energy Recovery website at http://www.energy.gov/recovery for up-to-date information regarding Recovery Act funding.

[b] Other Project Costs shown are funded through laboratory overhead.

[c] This project has not yet established a performance baseline. Cost and schedule estimates are preliminary.

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act[a]	FY 2010	FY 2011	Outyears	Total
Energy Sciences Building at ANL (10-SC-71)							
TEC	0	0	0	8,000	15,000	TBD	84,500-95,000
OPC[b]	0	956	0	44	0	0	1,000
TPC	0	956	0	8,044	15,000	TBD	85,500–96,000[c]
Renovate Science Laboratories, Phase II, at BNL (10-SC-72)							
TEC	0	0	0	5,000	15,000	TBD	45,000-50,000
OPC[b]	0	737	0	63	0	0	800
TPC	0	737	0	5,063	15,000	TBD	45,800–50,800[c]
Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, at LBNL (09-SC-72)							
TEC	0	12,495	15,000	34,027	20,103	TBD	91,900-94,600
OPC[b]	1,945	309	0	2	104	120	2,480
TPC	1,945	12,804	15,000	34,029	20,207	TBD	94,380–97,080[c]
Interdisciplinary Science Building, Phase I, at BNL (09-SC-73)							
TEC	0	8,240	18,673	39,387	0	TBD	61,300-66,300
OPC[b]	500	0	0	0	0	0	500
TPC	500	8,240	18,673	39,387	0	TBD	61,800–66,800[c]
Technology and Engineering Development Facility at TJNAF (09-SC-74)							
TEC	0	3,700	0	27,687	20,800	20,013	72,200
OPC[b]	287	509	0	204	0	0	1,000
TPC	287	4,209	0	27,891	20,800	20,013	73,200
Modernization of Laboratory Facilities at ORNL (08-SC-71)							
TEC	9,329	25,103	60,568	0	0	0	95,000
OPC[ab]	1,100	100	0	0	100	0	1,300
TPC	10,429	25,203	60,568	0	100	0	96,300

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[a] The Recovery Act Current Appropriation column reflects the planned allocation of funding from the American Recovery and Reinvestment Act of 2009, P.L. 111–5. See the Department of Energy Recovery website at http://www.energy.gov/recovery for up-to-date information regarding Recovery Act funding.

[b] Other Project Costs shown are funded through laboratory overhead.

[c] This project has not yet established a performance baseline. Cost and schedule estimates are preliminary.

(dollars in thousands)

	Prior Years	FY 2009	FY 2009 Recovery Act[a]	FY 2010	FY 2011	Outyears	Total
Physical Sciences Facility at PNNL (07-SC-05)							
TEC/TPC	45,669	52,775	0	0	0	0	98,444
Science Laboratories Infrastructure Project (MEL-001)							
TEC/TPC	17,472	11,759	0	0	0	0	29,231
Total, Construction							
TEC		114,072	94,241	121,001	119,355		
OPC[b]		3,311	0	2,163	304		
TPC		117,383	94,241	123,164	119,659		

Indirect Costs and Other Items of Interest

Institutional General Plant Projects (IGPP)

Institutional General Plant Projects are miscellaneous construction projects that have a total cost less than $5,000,000 in FY 2011 and are of a general nature (cannot be allocated to a specific program). IGPPs support multi-programmatic and/or inter-disciplinary programs and are funded through site overhead. Examples of IGPPs include site-wide maintenance facilities and utilities, such as roads and grounds outside the plant fences or a telephone switch that serves the entire facility.

The following displays IGPP funding by site:

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Argonne National Laboratory	9,395	7,000	7,400
Brookhaven National Laboratory	5,720	7,059	7,306
Lawrence Berkeley National Laboratory	4,100	4,100	4,500
Oak Ridge National Laboratory	18,118	20,000	23,000
Pacific Northwest National Laboratory	2,000	5,000	5,000
SLAC National Accelerator Laboratory	1,000	1,000	1,000
Total IGPP	40,333	44,159	48,206

Facilities Maintenance and Repair

General purpose infrastructure includes multiprogram research laboratories, administrative and support buildings, as well as cafeterias, power plants, fire stations, utilities, roads, and other structures. Together, the SC laboratories have over 1,400 operational buildings and real property trailers, with nearly 20 million gross square feet of space. The Department's facilities maintenance and repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded at SC laboratories are displayed in the following tables.

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[a] The Recovery Act Current Appropriation column reflects the planned allocation of funding from the American Recovery and Reinvestment Act of 2009, P.L. 111-5. See the Department of Energy Recovery website at http://www.energy.gov/recovery for up-to-date information regarding Recovery Act funding.

[b] Other Project Costs shown are funded through laboratory overhead.

Indirect-Funded Maintenance and Repair

Facilities maintenance and repair activities funded indirectly through overhead charges at SC laboratories are displayed below. Since this funding is allocated to all work done at each laboratory, the cost of these activities is allocated to SC and other DOE organizations, as well other Federal agencies and other entities doing work at SC laboratories. Maintenance reported to SC for non-SC laboratories is also shown.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Ames Laboratory	1,031	1,060	1,088
Argonne National Laboratory	31,402	31,402	36,433
Brookhaven National Laboratory	31,492	35,182	35,741
Fermi National Accelerator Laboratory	9,668	13,717	14,577
Lawrence Berkeley National Laboratory	17,800	20,300	21,700
Lawrence Livermore National Laboratory	2,563	2,614	2,666
Los Alamos National Laboratory	111	113	115
Oak Ridge Institute for Science and Education	381	334	341
Oak Ridge National Laboratory	41,053	41,997	42,921
Oak Ridge National Laboratory facilities at Y-12	588	602	615
Pacific Northwest National Laboratory	1,215	6,943	8,163
Princeton Plasma Physics Laboratory	5,813	6,392	6,611
Sandia National Laboratories	2,402	2,450	2,499
SLAC National Accelerator Laboratory	4,881	6,745	7,099
Thomas Jefferson National Accelerator Facility	3,540	3,700	3,855
Total, Indirect-Funded Maintenance and Repair	153,940	173,551	184,424

Direct-Funded Maintenance and Repair

Generally, facilities maintenance and repair expenses are funded through an indirect overhead charge. In some cases, however, a laboratory may charge maintenance directly to a specific program. One example would be when maintenance is performed in a building used only by a single program. These direct-funded charges are nonetheless in the nature of indirect charges, and therefore are not directly budgeted. The maintenance work for the Oak Ridge Office is direct funded and direct budgeted by the Science Laboratories Infrastructure program. A portion of the direct-funded maintenance and repair expenses reflects charges to non-SC programs performing work at SC laboratories.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Brookhaven National Laboratory	3,337	2,419	3,560
Fermilab National Accelerator Facility	113	113	123
Notre Dame Radiation Laboratory	157	160	169
Oak Ridge National Laboratory	18,507	18,933	19,349
Oak Ridge Office	4,994	5,213	5,071
Office of Scientific and Technical Information	338	355	364
SLAC National Accelerator Laboratory	9,092	6,583	8,266
Thomas Jefferson National Accelerator Facility	57	59	61
Total, Direct-Funded Maintenance and Repair	36,595	33,835	36,963

Deferred Maintenance Backlog Reduction

The total deferred maintenance backlog at the end of FY 2009at SC sites is estimated to be $489,000,000. SC is working to reduce the backlog of deferred maintenance at its laboratories. The table below shows the expected deferred maintenance reduction funding from laboratory overhead except for the Oak Ridge Reservation, which is direct funded. These funding amounts are included in the previous tables on direct and indirect funded maintenance.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Brookhaven National Laboratory	5,374	10,900	10,600
Lawrence Berkeley National Laboratory	2,500	2,000	3,000
Oak Ridge Institute for Science and Education	40	40	40
Oak Ridge Office	1,000	1,000	500
Princeton Plasma Physics Laboratory	177	340	300
Total, Deferred Maintenance Backlog Reduction	9,091	14,280	14,440

The primary strategy for reducing deferred maintenance is SC's Infrastructure Modernization Initiative, which will modernize the general purpose infrastructure at SC laboratories. The initiative focuses on increased funding for line item construction projects which will result in significant additional reductions to the deferred maintenance backlog. These reductions are not included in the table above, nor does the table include reductions resulting from IGPP, GPP and programmatic line items.

11-SC-70, Utilities Upgrade,
Fermi National Accelerator Laboratory, Batavia, Illinois
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on September 18, 2009. The anticipated preliminary Total Estimated Cost (TEC) range for this project is $31,300,000–$34,900,000.

A Federal Project Director at the appropriate level has been assigned to this project.

This Project Data Sheet is new for PED/Construction.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2011[a]	9/18/2009	TBD	TBD	TBD	TBD	TBD	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	4,450	TBD	TBD[b]	1,100	TBD	1,100	TBD[b]

4. Project Description, Justification, and Scope

Maintaining a dependable base from which science programs can be accomplished is dependent on robust, redundant, maintainable, and flexible utility systems. The backbone of Fermilab's utility systems is its Industrial Cooling Water (ICW) and High Voltage Electrical (HV) systems. Without these systems, science at Fermilab cannot exist. This project will upgrade both of these systems.

The ICW system consists of ponds, pumping stations, and approximately 72,000 feet of underground network piping, supplying process cooling and fire protection water throughout the laboratory's 6,800 acre site. As most of the system was installed during the construction of the lab almost 40 years ago, most components of the system have reached the end of their useful life. The fragile state of the piping and valves currently in service, reduction in flows by biofouling as well as frequent pipe failures jeopardize the reliability and maintainability of the ICW system. The current state of the system requires frequent and unscheduled repairs which are complicated by insufficient and often malfunctioning isolation valves, enlarging the disabled area being repaired. Reliable process cooling and fire protection water service cannot be provided to current accelerator and experimental facilities areas as well as those areas slated for development of future facilities unless substantial re-investment in the lab's ICW system is provided.

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[a] This project is pre-CD-2 and schedules are preliminary. Construction funds will not be executed without appropriate CD approvals.

[b] This project is pre-CD-2 and cost estimates are preliminary. The TEC range for this project is $31,300,000 to $34,900,000. The Total Project Cost (TPC) range for this project is $32,400,000 to $36,000,000.

The high voltage electrical system consists of substations, switches, and transformers. Various elements of the high voltage distribution system are rated as poor based on their current condition, are unreliable, and will continue to deteriorate with age. Future science at Fermilab is dependent upon a robust, redundant, maintainable, and flexible high voltage electrical distribution system for both programmatic and conventional power needs. The master substation and numerous oil switches and transformers across the site were installed during the original construction of the laboratory in the early 1970's. Much of this equipment is now beyond its useful life, and substantial reinvestment in this system is required for continued science in support of the Fermilab mission.

This project will upgrade and expand these utilities to provide a reliable and flexible base to serve existing facilities and provide the backbone from which future projects will build to serve new facilities. This will establish a stable base from which to serve both programmatic and conventional requirements across the site. A detailed alternatives analysis using life-cycle costs will be conducted prior to CD-1. The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assetsand all appropriate project management requirements have been met. FY 2010 OPC funds, funded through laboratory overhead, are being used to complete the conceptual design in preparation for CD-1. FY 2011 PED funds will be used to complete preliminary and final designs for all aspects of the project. The total design period for this project is expected to be significantly less than 18 months. FY 2011 construction funds are being requested because the scope of the project is straight forward and the design duration will be short, thereby permitting transition to construction during the same fiscal year. FY 2011 construction funds will be used for procurement of long lead items and to start construction work as well as for project management and support activities.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED[a]			
FY 2011	4,450	4,450	4,450
Total, PED	4,450	4,450	4,450
Construction			
FY 2011	3,074	3,074	1,000
Outyears	TBD	TBD	TBD
Total, Construction	TBD	TBD	TBD
TEC			
FY 2011	7,524	7,524	5,450
Outyears	TBD	TBD	TBD
Total, TEC[b]	TBD	TBD	TBD
Other Project Cost (OPC)[c]			
OPC except D&D			
FY 2010	1,100	1,100	1,100
Total, OPC except D&D	1,100	1,100	1,100
Total Project Cost (TPC)			
FY 2010	1,100	1,100	1,100
FY 2011	7,524	7,524	5,450
Outyears	TBD	TBD	TBD
Total, TPC[b]	TBD	TBD	TBD

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[a] All design will be complete in less than eighteen months.

[b] This project has not yet received approval of CD-2; therefore cost and schedule estimates are preliminary. The preliminary TEC range is $31,300,000 to $34,900,000. The TPC range for this project is $32,400,000 to $36,000,000.

[c] Other Project Costs are funded through laboratory overhead.

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[a]			
Design	3,350	N/A	N/A
Contingency	1,100	N/A	N/A
Total, PED	4,450	N/A	N/A
Construction			
Construction	2,459	N/A	N/A
Contingency	615	N/A	N/A
Total, Construction	3,074	N/A	N/A
Total, TEC[b]	7,524	N/A	N/A
Contingency, TEC	1,715	N/A	N/A
Other Project Cost (OPC)[c]			
OPC except D&D			
Conceptual Planning	500	N/A	N/A
Conceptual Design	400	N/A	N/A
Contingency	200	N/A	N/A
Total, OPC except D&D	1,100	N/A	N/A
Total, OPC	1,100	N/A	N/A
Contingency, OPC	200	N/A	N/A
Total, TPC[b]	8,624	N/A	N/A
Total, Contingency	1,915	N/A	N/A

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[a] All design will be complete in less than 18 months.

[b] This project has not yet received approval of CD-2; therefore construction and TEC estimated displayed only include anticipated activities through 2011. The preliminary TEC range for this project is $31,300,000 to $34,900,000. The TPC range for this project is $32,400,000 to $36,000,000.

[c] Other Project Costs are funded through laboratory overhead.

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2011	TEC	0	7,524	TBD	TBD	TBD	TBD	TBD[a]
	OPC[b]	1,100	0	0	0	0	0	1,100
	TPC	1,100	7,524	TBD	TBD	TBD	TBD	TBD[a]

8. Related Operations and Maintenance Funding Requirements

Not applicable. Project does not have CD-2 approval.

9. Required D&D Information

Not applicable. Project does not have CD-2 approval.

10. Acquisition Approach

Not applicable. Project does not have CD-2 approval.

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[a] This project has not yet received approval of CD-2; therefore cost and schedule estimates are preliminary. The preliminary TEC range for this project is $31,300,000 to $34,900,000. The TPC range for this project is $32,400,000 to $36,000,000.

[b] Other Project Costs are funded through laboratory overhead.

11-SC-71, Utility Infrastructure Modernization
Thomas Jefferson National Accelerator Facility
Newport News, Virginia
Project Data Sheet is for PED/Construction

1. Significant Changes

DOE O 413.3A Critical Decision (CD)-0, Approve Mission Need, was received September 18, 2009. The anticipated preliminary Total Estimated Cost (TEC) range for this project is $24,300,000–$29,200,000.

A Federal Project Director at the appropriate level has been assigned to this project.

This Project Data Sheet is new for PED/Construction.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2011[a]	9/18/2009	TBD	TBD	TBD	TBD	TBD	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	1,800	TBD	TBD[b]	650	N/A	650	TBD[b]

4. Project Description, Justification, and Scope

The Thomas Jefferson National Accelerator Facility (TJNAF) cryogenic, power distribution, cooling water, and communication systems are experiencing failure at increasing frequencies and have insufficient capacity to meet current and forecasted need. These utility system gaps jeopardize the laboratory's capability to deliver its mission, to contribute to enabling technologies and emerging fields, and to support ongoing research programs at TJNAF, as well as other DOE national and international projects.

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[a] This project is pre-CD-2 and schedules are preliminary. Construction funds will not be executed without appropriate CD approvals.

[b] This project is pre-CD-2 and cost estimates are preliminary. The preliminary TEC range is $24,300,000 to $29,200,000. The preliminary Total Project Cost (TPC) range is $24,950,000 to $29,850,000.

The cryogenic, power distribution, cooling water, and communication systems are 20 to 40 years old, as they dating back to the previous owner. The cryogenic system has insufficient capacity and despite gains over the past several years on significantly improving the efficiency of major system components, there remains a need for overall system efficiency optimization. Currently, the cryogenic capacity is inadequate to support the needs in the Test Lab, which is the key facility for Superconducting Radiofrequency (SRF) development and production activities. The lack of adequate cryogenic capacity is a limiting factor on scheduling SRF activities. Cryogenic system operation at TJNAF accounts for over 90% of annual electricity costs. Therefore, efficiency gains in this system will significantly contribute to a reduction in overall operating costs. Electricity energy savings from an upgrade to the Cryogenic Test Facility, a key component in the cryogenic system, are estimated to be 36%.

The capacity of the power distribution system is currently taxed to its limit and will not support future projected needs. The power distribution system does not have the necessary redundancy to maintain operation of critical systems during partial power outages. The most critical element of this gap is the inability to restart the Central Helium Liquefier (CHL) from the alternate power feed when the primary feed has an outage. The CHL is the largest component in the site cryogenic system and is critical to maintaining constant cryogenic temperatures in the accelerator cryomodules, necessary to prevent degradation of accelerator performance and costly repairs. Electric feeders are at the end of their service life and are near failing. Insulation cracks have been observed on multiple feeders. Recent interruptions to accelerator operation due to failed components of the electrical supply heighten this concern.

The cooling water distribution system is suffering frequent failures and has insufficient capacity to support optimal experimental program scheduling, computer center heat loads, and future expected growth. Over the past year, failure of the cooling water distribution system has caused several weeks of down time for the Free Electron Laser facility. Cooling towers are well past their efficient life cycle utilization and are requiring ever increasing amounts of maintenance. In addition, there is an estimated energy savings from addressing this gap of 10%.

Subsurface communications systems are outdated and unreliable. Because some of these systems are over 40 years old, replacement components are often unavailable. Phone switch parts are difficult to locate and no additional cabling capacity is available for telecommunications or data lines. Inadequate capacity is impacting the ability to install communications to support staff growth and replace degraded cables as necessary. These systems have reached the end of their life cycle. Consequently, instances of phone outages are impacting the efficiency of operations. The underground copper wiring is also past its service life. In addition, installation of an Emergency Broadcast System is necessary to meet safety goals and improve efficiency of response.

The proposed solutions under this project to address the utility system performance gaps at TJNAF are relatively non-complex and include upgrades and expansion of cryogenic, electrical power distribution, cooling water, and communication systems. A detailed alternatives analysis using life-cycle costs will be conducted prior to CD-1.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met. FY 2010 OPC funds, funded through laboratory overhead, are used to complete the conceptual design in preparation for CD–1. FY 2011 PED funds will be used to complete preliminary and final designs for all aspects of the project. The total design period for this project is expected to be significantly less than 18 months. FY 2011 construction funds are being requested because the scope of the project is straight forward and the design duration will be short, thereby permitting transition to construction during the same fiscal year. FY 2011 construction funds will be used for procurement of long lead items and to start construction work as well as for project management and support activities.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED[a]			
FY 2011	1,800	1,800	1,800
Construction			
FY 2011	6,028	6,028	2,000
Outyears	TBD	TBD	TBD
Total, Construction	TBD	TBD	TBD
TEC			
FY 2011	7,828	7,828	3,800
Outyears	TBD	TBD	TBD
Total, TEC[b]	TBD	TBD	TBD
Other Project Cost (OPC)[c]			
OPC except D&D			
FY 2010	650	650	650
Total Project Cost (TPC)			
FY 2010	650	650	650
FY 2011	7,828	7,828	3,800
Outyears	TBD	TBD	TBD
Total, TPC[b]	TBD	TBD	TBD

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[a] Design will be complete in less than 18 months.

[b] This project has not yet received approval of CD-2; therefore cost and schedule estimates are preliminary. The preliminary TEC range is $24,300,000 to $29,200,000. The preliminary TPC range is $24,950,000 to $29,850,000.

[c] Other Project Costs are funded through laboratory overhead.

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[a]			
Design	1,700	N/A	N/A
Contingency	100	N/A	N/A
Total, PED	1,800	N/A	N/A
Construction			
Other Construction	5,023	N/A	N/A
Contingency	1,005	N/A	N/A
Total, Construction	6,028	N/A	N/A
Total, TEC[b]	7,828	N/A	N/A
Contingency, TEC	1,105	N/A	N/A
Other Project Cost (OPC)[c]			
OPC except D&D			
Conceptual Planning	650	N/A	N/A
Start-Up	N/A	N/A	N/A
Total, OPC except D&D	650	N/A	N/A
D&D			
D&D	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, D&D	N/A	N/A	N/A
Total, OPC	650	N/A	N/A
Total, TPC[b]	8,478	N/A	N/A
Total, Contingency	1,105	N/A	N/A

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[a] All design will be complete in less than 18 months.

[b] This project has not yet received approval of CD-2; therefore, construction and TEC estimate displayed only include anticipated activities through FY 2011. The preliminary TEC range is $24,300,000 to $29,200,000. The preliminary TPC range is $24,950,000 to $29,850,000.

[c] Other Project Costs are funded through laboratory overhead.

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2011	TEC	0	7,828	TBD	TBD	TBD	TBD	TBD[b]
	OPC[a]	650	0	0	0	0	0	TBD
	TPC	650	7,828	TBD	TBD	TBD	TBD	TBD[b]

8. Related Operations and Maintenance Funding Requirements

Not applicable. Project does not yet have CD-2 approval.

9. Required D&D Information

Not applicable. Project does not yet have CD-2 approval.

10. Acquisition Approach

Not applicable. Project does not yet have CD-2 approval.

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[a] Other Project Costs are funded through laboratory overhead.

[b] This project has not yet received approval of CD-2; therefore cost and schedule estimates are preliminary. The preliminary TEC range is $24,300,000 to $29,200,000. The preliminary TPC range is $24,950,000 to $29,850,000.

10-SC-70, Research Support Building and Infrastructure Modernization, SLAC National Accelerator Laboratory, Menlo Park, California
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, that was approved on November 3, 2009, with a preliminary Total Estimated Cost (TEC) range of $80,000,000–$96,000,000.

A Federal Project Director with certification level II has been assigned to this project.

This Project Data Sheet is for PED/Construction.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2/3A	CD-3B	CD-4	D&D Start	D&D Complete
FY 2010	10/10/2008	1Q FY 2010	2Q FY 2011	TBD	TBD	TBD	TBD	TBD
FY 2011[a]	10/10/2008	11/3/2009	4Q FY 2011	4Q FY 2010	4Q FY 2012	1Q FY 2015	4Q FY 2011	2Q FY 2015

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2010	8,900	TBD	TBD	1,400	TBD	TBD	TBD
FY 2011[b]	8,900	87,100	96,000	1,400	N/A	1,400	97,400

4. Project Description, Justification, and Scope

SLAC National Accelerator Laboratory is an Office of Science laboratory that supports a large national and international community of scientific users performing cutting edge research in support of the Department of Energy mission. Success of that mission is directly coupled to the general purpose infrastructure necessary to conduct this research. At SLAC, accomplishment of that mission is currently at risk given substandard buildings that do not provide the appropriate environment to conduct world class science or mission support functions.

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[a] This project is pre-CD-2, and the schedule is preliminary. Construction funds will not be executed without appropriate CD approvals.

[b] This project is pre-CD-2 and cost estimates are preliminary. The preliminary TEC range is $80,000,000 to $96,000,000. The preliminary Total Project Cost (TPC) range for this project is $81,400,000 to $97,400,000.

SLAC has moved from a single program to a multi-program laboratory; this transition, combined with the condition and age of SLAC facilities, drives the need to consolidate core research functions and modernize key support buildings. The most pressing infrastructure gaps are the lack of appropriate space to house and co-locate accelerator scientists and key mission support staff who are currently spread across the laboratory in outdated and inefficient facilities.

To correct these deficiencies, a new building is proposed to house the laboratory's accelerator scientists. This new building will replace numerous 40-year-old trailers that currently support these scientists. This will enable integration of the accelerator science and technology community across programmatic boundaries, allowing these scientists to better support the science missions at the laboratory. In addition, renovation of two buildings is proposed (028 and 041). These buildings house key mission support functions and were part of the original construction of the laboratory in the mid-1960s. Although the basic core and shell construction are sound, their interior spaces and utility system are obsolete. Overall, the proposed project will upgrade working conditions for over 20% of the laboratory staff in a way that supports the laboratory vision of a unified culture with a strong sense of community between all scientific and support functions across the laboratory.

According to the latest preliminary project execution plan, new construction is anticipated to be in the range of 53,000 to 64,000 square feet; approximately 64,000 square feet of existing space will undergo renovation, and demolition of approximately 20,000 square feet will be completed to provide the site for the new construction. The remaining balance of gross square feet to be demolished to meet the one-for-one replacement will be from banked excess.

FY 2009 OPC funds, funded through laboratory overhead, were used to complete the Conceptual Design Report in preparation for CD-1, which was approved on November 3, 2009. FY 2010 and FY 2011 PED funding will be used for design of the project, including project management and all associated support functions. FY 2011 construction funding will support early procurement and construction activities, including project management and all associated support functions.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED[a]			
FY 2010	6,900	6,900	5,900
FY 2011	2,000	2,000	3,000
Total, PED	8,900	8,900	8,900
Construction			
FY 2011	30,200	30,200	19,200
FY 2012	19,700	19,700	TBD
FY 2013	36,300	36,300	TBD
FY 2014	0	0	TBD
Total, Construction	86,200	86,200	86,200
D&D			
FY 2011	900	900	900
Total, D&D	900	900	900
TEC			
FY 2010	6,900	6,900	5,900
FY 2011	33,100	33,100	22,200
FY 2012	19,700	19,700	TBD
FY 2013	36,300	36,300	TBD
FY 2014	0	0	TBD
Total, TEC[b]	96,000	96,000	96,000
Other Project Cost (OPC)[c]			
OPC except D&D			
FY 2009	700	700	700
FY 2010	100	100	100
FY 2011	100	100	100
FY 2012	150	150	150
FY 2013	300	300	300
FY 2014	50	50	50
Total, OPC except D&D	1,400	1,400	1,400

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[a] All design will be complete in less than eighteen months.

[b] This project is pre-CD-2 and cost and schedule estimates are preliminary. The TEC range for this project is $80,000,000 to $96,000,000. The TPC range for this project is $81,400,000 to $97,400,000.

[c] Other Project Costs are funded through laboratory overhead.

(dollars in thousands)	Appropriations	Obligations	Costs
Total Project Cost (TPC)			
FY 2009	700	700	700
FY 2010	7,000	7,000	6,000
FY 2011	33,200	33,200	22,300
FY 2012	19,850	19,850	TBD
FY 2013	36,600	36,600	TBD
FY 2014	50	50	TBD
Total, TPC[a]	97,400	97,400	97,400

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate[b]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[c]			
Design	6,675	6,675	N/A
Contingency	2,225	2,225	N/A
Total, PED	8,900	8,900	N/A
Construction			
Construction	69,200	TBD	N/A
Contingency	17,000	TBD	N/A
Total, Construction	86,200	TBD	N/A
D&D			
D&D	700	TBD	N/A
Contingency	200	TBD	N/A
Total, D&D	900	TBD	N/A
Total, TEC[a]	96,000	8,900	N/A
Contingency, TEC	19,425	2,225	N/A

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[a] This project is pre-CD-2 and cost and schedule estimates are preliminary. The TEC range for this project is $80,000,000 to $96,000,000. The TPC range for this project is $81,400,000 to $97,400,000.
[b] Previous estimates shown only included partial funding.
[c] Design will be complete in less than 18 months.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC			
Other OPC	900	900	N/A
Start-Up	300	300	N/A
Contingency	200	200	N/A
Total, OPC	1,400	1,400	N/A
Total, TPC[a]	97,400	10,300	N/A
Total, Contingency	19,625	2,425	N/A

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2010	TEC	0	8,900	TBD	TBD	TBD	TBD	TBD	TBD
	OPC[b]	500	900	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	500	9,800	TBD	TBD	TBD	TBD	TBD	TBD
FY 2011	TEC	0	6,900	33,100	19,700	36,300	0	0	96,000[a]
	OPC[a]	700	100	100	150	300	50	0	1,400
	TPC	700	7,000	33,200	19,850	36,600	50	0	97,400[a]

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	FY 2014
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	FY 2064

(Related Funding requirements)

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	399	N/A	10,266	N/A
Maintenance	1,722	N/A	44,481	N/A
Total, Operations & Maintenance	2,121	N/A	54,747	N/A

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[a] This project is pre-CD-2 and cost and schedule estimates are preliminary. The TEC range for this project is $80,000,000 to $96,000,000. The TPC range for this project is $81,400,000 to $97,400,000.

[b] Other Project Costs are funded through laboratory overhead.

9. Required D&D Information

This project will include demolition of approximately 20,000 square feet to clear the proposed site for the new construction. The remaining balance of gross square feet to be demolished to meet the one-for-one replacement will be from banked excess.

10. Acquisition Approach

Not applicable. Project does not have CD-2 at this time.

10-SC-71, Energy Sciences Building
Argonne National Laboratory, Argonne, IL
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-1 Approve Alternative Selection and Cost Range which was approved on September 2, 2009, with a preliminary Total Estimated Cost (TEC) range of $84,500,000 to $95,000,000.

A Federal Project Director has been assigned to this project. The Federal Project Director is pursuing the appropriate certification level.

This Project Data Sheet is for PED/Construction

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3A	CD-3B	CD-4
FY 2010	10/10/2008	4Q FY 2009	2Q FY 2011	TBD	TBD	TBD	TBD
FY 2011[a]	10/10/2008	09/02/2009	2Q FY 2011	2Q FY 2011	2Q FY 2011	2Q FY 2012	4Q FY 2014

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Ranges
CD-2 – Approve Performance Baseline
CD-3A – Approve Start of Site Preparation
CD-3B – Approve Start of Building Construction
CD-4 – Approve Start of Operations or Project Closeout

(fiscal quarter or date)

	D&D Start	D&D Complete
FY 2010	TBD	TBD
FY 2011[a]	N/A	N/A

D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC[b] Except D&D	OPC, D&D	OPC, Total	TPC
FY 2010	10,000	TBD	TBD	1,000	TBD	TBD	TBD
FY 2011[c]	10,000	85,000	95,000	1,000	N/A	1,000	96,000

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[a] This project is pre-CD-2, and the schedule is preliminary. Construction funds will not be executed without appropriate CD approvals.

[b] Other Project Costs are funded through laboratory overhead.

[c] This project is pre-CD2; preliminary cost estimates are shown for TEC and TPC. The preliminary TEC range for this project is $84,500,000 to $95,000,000. The preliminary Total Project Cost (TPC) range for this project is $85,500,000 to $96,000,000.

4. Project Description, Justification, and Scope

This project will provide between 125,000 and 150,000 gross square feet of new energy efficient and environmentally sustainable laboratory space at Argonne National Laboratory (ANL). The new facility will provide modern, 21st-century, high-accuracy laboratories for energy-related research and development (R&D) and associated space for support functions. The design will utilize modern, efficient laboratory planning benchmarks as the basis for determining the size and configuration of space types. The design of the space will also emphasize more open, collaborative environments and flexibility to respond to future mission changes. In addition to the research laboratories, the building will include office space for researchers, small group conference rooms, equipment areas, restrooms, circulation space, and supporting infrastructure.

The objective of the Energy Sciences Building (ESB) project is to provide high-accuracy, flexible, and sustainable laboratory and office space to support scientific theory/simulation, materials discovery, characterization, and application of new energy-related materials and processes. Efficient, high-accuracy heating, ventilation, and air conditioning systems will be installed to support cutting edge research and the operation of sensitive instrumentation. Comparable space is not available at ANL. The scope of the project includes design, construction, and necessary furniture and equipment for the new facility as well as extension of existing site utilities to the new building.

Key areas of energy research to be housed in the ESB include discovery synthesis, biomimetics, solar energy, catalysis, fuel cell research, and electrical energy storage. These research areas currently lack modern scientific space needed for seamless multi-disciplinary collaborative research, the hallmark of 21st century science and engineering.

ANL research buildings dedicated to the SC energy research mission are all more than 40 years old, some as much as 55 years old. They require constant repair and frequently compromise or halt scientific research and are unable to meet modern standards for high resolution apparatus requiring vibration, electromagnetic, and thermal stability. Electrical power in these facilities is unstable and insufficient for modern synthesis and measurement instruments to operate at rated performance levels. Temperature and humidity controls were designed for human comfort only and not for state-of-the-art experimental performance, resulting in erratic temperature and humidity fluctuations over a few hours requiring frequent recalibration of apparatus to achieve sufficient measuring accuracy. Several key laboratories can operate only at night because of excessive vibration, temperature, and power fluctuations in the daytime, significantly impeding productivity. In addition to the functional inadequacies described above, safety and building code non-compliances further compromise ANL's ability to support SC and the Department's long-term energy goals. Antiquated and/or outdated electrical, fire protection, and ventilation systems have resulted in numerous National Electric and National Fire Protection Association code deficiencies. The age of these facilities and systems as well as the inability to obtain replacement parts has limited ANL's ability to correct these deficiencies via replacement and/or capital improvements.

FY 2009 OPC funds, funded through laboratory overhead, were used to complete the Conceptual Design Report in preparation for CD-1, approved on September 2, 2009. FY 2010 and FY 2011 PED funding will be used for design of the project, including project management and all associated support functions. FY 2011 construction funding will support early procurement and construction activities on this project, including project management and all associated support functions.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED[a]			
FY 2010	8,000	8,000	7,000
FY 2011	2,000	2,000	3,000
Total, PED	10,000	10,000	10,000
Construction			
FY 2011	13,000	13,000	10,000
FY 2012	45,000	45,000	TBD
FY 2013	27,000	27,000	TBD
FY 2014	0	0	TBD
Total, Construction	85,000	85,000	85,000
TEC			
FY 2010	8,000	8,000	7,000
FY 2011	15,000	15,000	13,000
FY 2012	45,000	45,000	TBD
FY 2013	27,000	27,000	TBD
FY 2014	0	0	TBD
Total, TEC[b]	95,000	95,000	95,000
Other Project Cost (OPC)[c]			
OPC except D&D			
FY 2009	956	956	956
FY 2010	44	44	44
Total, OPC except D&D	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2009	956	956	956
FY 2010	8,044	8,044	7,044
FY 2011	15,000	15,000	13,000

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[a] All design will be complete in less than 18 months.

[b] This project is pre-CD-2. The preliminary TEC range for this project is $84,500,000 to $95,000,000. The preliminary TPC range for this project is $85,500,000 to $96,000,000.

[c] Other Project Costs are funded through laboratory overhead.

(dollars in thousands)

	Appropriations	Obligations	Costs
FY 2012	45,000	45,000	TBD
FY 2013	27,000	27,000	TBD
FY 2014	0	0	TBD
Total, TPC[c]	96,000	96,000	96,000

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[b]			
Design	8,334	8,688	N/A
Contingency	1,666	1,312	N/A
Total, PED	10,000	10,000	N/A
Construction			
Other Construction	70,707	TBD	N/A
Contingency	14,293	TBD	N/A
Total, Construction	85,000	TBD	N/A
Total, TEC[c]	95,000	TBD	N/A
Contingency, TEC	15,959	TBD	N/A
Other Project Cost (OPC)[d]			
OPC except D&D			
Conceptual Planning	263	263	N/A
Conceptual Design	737	603	N/A
Contingency	0	134	N/A
Total, OPC except D&D	1,000	1,000	N/A
Total, OPC	1,000	1,000	N/A
Contingency, OPC	0	134	N/A
Total, TPC[c]	96,000	TBD	N/A
Total, Contingency	16,093	TBD	N/A

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[a] Previous estimates shown only included partial funding.

[b] All design will be complete in less than 18 months.

[c] This project has not yet received approval of CD-2.The preliminary TEC range for this project is $84,500,000 to $95,000,000. The preliminary TPC range for this project is $85,500,000 to $96,000,000.

[d] Other Project Costs are funded through laboratory overhead.

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2010	TEC	0	10,000	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	1,000	0	0	0	0	0	0	TBD
	TPC	1,000	10,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2011	TEC	0	8,000	15,000	45,000	27,000	0	0	95,000[b]
	OPC[a]	956	44	0	0	0	0	0	1,000
	TPC	956	8,044	15,000	45,000	27,000	0	0	96,000[b]

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	FY 2014
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	FY 2064

(Related Funding requirements)

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	733	N/A	96,182	N/A
Maintenance	1,153	N/A	37,363	N/A
Total, Operations & Maintenance	1,886	N/A	133,545	N/A

9. Required D&D Information

This project has secured "banked space" from prior Nuclear Footprint Reduction efforts at Argonne as well as demolition projects at other Office of Science facilities to meet the one for one requirement for offsetting space.

10. Acquisition Approach

The ESB project Acquisition Strategy was approved on January 7, 2009.

The M&O Contractor, Argonne University of Chicago, LLC, will have prime responsibility for oversight of both the design and construction subcontracts.

Various acquisition alternatives were considered for this project. After considering all alternatives in relation to the schedule, size, and risk, the use of a tailored Design-Bid-Build approach with design by an Architectural/Engineering firm, construction management services through the industrial partnership, and construction by a General Contractor, all led by the M&O Contractor integrated project team, was deemed to provide the best construction delivery method and the lowest risk. In addition, the M&O Contractor's standard procurement practice is to use firm fixed-priced contracts, and the M&O Contractor has extensive experience in project management, construction management, and ES&H management systems in the acquisition of scientific facilities.

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[a] Other Project Costs are funded through laboratory overhead.

[b] This project has not yet received approval of CD-2. The preliminary TEC range for this project is $84,500,000 to $95,000,000. The preliminary TPC range for this project is $85,500,000 to $96,000,000.

10-SC-72, Renovate Science Laboratories, Phase II
Brookhaven National Laboratory (BNL), Upton, New York
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on September 2, 2009, with a preliminary Total Estimated Cost (TEC) range of $45,000,000 to $50,000,000.

A Federal Project Director with certification level II has been assigned to this project.

This Project Data Sheet is for PED/Construction.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1 (Design Start)	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2010	10/10/2008	4Q FY 2009	3Q FY 2011	TBD	TBD	TBD	N/A	N/A
FY 2011[a]	10/10/2008	9/2/2009	2Q FY 2011	1Q FY 2011	4Q FY 2011	2Q FY 2014	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D[b]	OPC, D&D	OPC, Total	TPC
FY 2010	7,000	TBD	TBD	800	TBD	TBD	TBD
FY 2011[c]	7,000	43,000	50,000	800	TBD	800	50,800

4. Project Description, Justification, and Scope

A large number of scientists and researchers at BNL are conducting science in laboratories built over forty years ago. Although their basic building core and shell construction is sound, the lab and office spaces and their utilities and environmental support systems are totally obsolete.

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[a] This project is pre-CD-2, and schedules are preliminary. Construction funds will not be executed without appropriate CD approvals.

[b] Other Project Costs are funded through laboratory overhead.

[c] This project is pre-CD-2, and cost estimates are preliminary. Preliminary Total Estimated Cost (TEC) range is $45,000,000 to $50,000,000. Preliminary Total Project Cost (TPC) range is $45,800,000 to $50,800,000.

The laboratories in Building 510 for the Physics Department were constructed in 1962 and are desperately in need of renovation and modernization in order to keep pace with the highly complex and rapidly changing technologies required for work on advanced new detectors. This work involves sophisticated electronics, high precision mechanical assemblies, and extremely clean work areas for detectors such as silicon or gas filled devices. A task force conducted a condition assessment of the laboratories and developed a list of deficiencies that included damaged floors and ceilings, roof and ceiling leaks, old and unused plumbing, poor lighting levels, decrepit lab facilities, poor temperature control and ventilation, significant particulate discharge from heating, ventilation, and air conditioning systems, high electromagnetic interference noise on electrical power in certain laboratories, and lack of fire sprinkler protection.

Building 555 has a robust design for chemical sciences research, but was constructed in 1966 and now has a number of substantial limitations for current research needs. While Building 555 has an effective design for wet chemistry, it needs to be renovated to address very serious infrastructure quality issues that have grown over the years. Its design can also accommodate the evolving need for laser and instrumentation space for many of the physical methods in use, but an upgrade of facilities for air, water and electrical is critical, and selective lab reconfiguration is needed to best meet advanced instrumentation needs.

The proposed Renovate Science Labs, Phase II Project will upgrade and rehabilitate existing, obsolete, and unsuitable BNL laboratory facilities into modern, efficient laboratory spaces compatible with world-class scientific research. This project will revitalize and modernize laboratories and support space located in each of 2 buildings, Building 510 Physics and Building 555 Chemistry.

FY 2009 other project costs (OPC) funds, funded through laboratory overhead, were used to complete the Conceptual Design Report in preparation for CD-1, which was approved September 2, 2009.
FY 2010 and FY 2011 PED will be used for design of the project, including project management and all associated support functions. FY 2011 construction funds will be used to start construction on the project.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED[a]			
FY 2010	5,000	5,000	3,000
FY 2011	2,000	2,000	4,000
Total, PED	7,000	7,000	7,000

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[a] Design will be completed in less than 18 months.

(dollars in thousands)

	Appropriations	Obligations	Costs
Construction			
FY 2011	13,000	13,000	3,000
FY 2012	22,000	22,000	TBD
FY 2013	8,000	8,000	TBD
Total, Construction	43,000	43,000	TBD
TEC			
FY 2010	5,000	5,000	3,000
FY 2011	15,000	15,000	7,000
FY 2012	22,000	22,000	TBD
FY 2013	8,000	8,000	TBD
Total, TEC[a]	50,000	50,000	50,000
Other Project Cost (OPC)[b]			
OPC except D&D			
FY 2009	737	737	737
FY 2010	63	63	63
Total, OPC except D&D	800	800	800
Total Project Cost (TPC)			
FY 2009	737	737	737
FY 2010	5,063	5,063	3,063
FY 2011	15,000	15,000	7,000
FY 2012	22,000	22,000	TBD
FY 2013	8,000	8,000	TBD
Total, TPC[a]	50,800	50,800	50,800

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[a] This project is pre-CD-2, and cost estimates are preliminary. Preliminary TEC range is $45,000,000 to $50,000,000. Preliminary TPC range is $45,800,000 to $50,800,000.

[b] Other Project Costs are funded through laboratory overhead.

6. Details of Project Cost Estimate

	(dollars in thousands)		
	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[b]			
Design	6,200	6,200	N/A
Contingency	800	800	N/A
Total, PED	7,000	7,000	N/A
Construction			
Other Construction	34,400	N/A	N/A
Contingency	8,600	N/A	N/A
Total, Construction	43,000	N/A	N/A
Total, TEC[c]	50,000	N/A	N/A
Contingency, TEC	9,400	N/A	N/A
Other Project Cost (OPC)[d]			
OPC except D&D			
Conceptual Planning	150	150	N/A
Conceptual Design	650	600	N/A
Contingency	0	50	N/A
Total, OPC except D&D	800	800	N/A
Total, OPC	800	800	N/A
Contingency, OPC	0	50	N/A
Total, TPC[a]	50,800	7,800	N/A
Total, Contingency	9,450	850	N/A

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[a] Previous estimates shown only included partial estimates.

[b] All design will be complete in less than 18 months.

[c] This project is pre-CD-2, and cost estimates are preliminary. Preliminary Total Estimated Cost (TEC) range is $45,000,000 to $50,000,000. Preliminary Total Project Cost (TPC) range is $45,800,000 to $50,800,000.

[d] Other Project Costs are funded through laboratory overhead.

7. Funding Profile History

(dollars in thousands)

Request Year		FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	Total
FY 2010	TEC	0	7,000	TBD	TBD	TBD	TBD
	OPC	800	0	0	0	0	800
	TPC	800	7,000	TBD	TBD	TBD	TBD
FY 2011	TEC	0	5,000	15,000	22,000	8,000	50,000[a]
	OPC[b]	737	63	0	0	0	800
	TPC	737	5,063	15,000	22,000	8,000	50,800[a]

8. Related Operations and Maintenance Funding Requirements

Project is a renovation of existing space within existing buildings. No additional Operations and Maintenance funding is required.

9. Required D&D Information

The project will not require demolition of a sufficient amount of excess facilities to meet space offsetting requirements for a new building at the BNL site. The project is a renovation of existing space. No new space shall be constructed.

10. Acquisition Approach

Design will be performed by an Architect-Engineer (A-E) with the subcontract managed by the BNL operating contractor. The A-E will be competitively selected based on qualifications. After completion of the design, the BNL operating contractor will solicit offers from prospective large and small business general construction firms, and award a firm fixed price construction subcontract. Evaluation of offers will include consideration of each offeror's relative experience, safety record, and past performance in successfully completing similar construction projects. Award will then be made to one qualified responsible, responsive offeror.

09-SC-72, Seismic Life-Safety, Modernization, and Replacement of General Purpose Buildings, Phase II, Lawrence Berkeley National Laboratory (LBNL), Berkeley, California
Project Data Sheet is for PED/Construction

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD-2A/2B/3A, Approve Performance Baseline (Phase A and B) and Approve Start of Construction (Phase A), which was approved on August 21, 2009. This project has a Total Estimated Cost (TEC) range of $91,900,000 to $94,600,000.

A Federal Project Director with a certification level II has been assigned to this project.

This Project Data Sheet (PDS) is for PED/Construction. This PDS is an update of the FY 2010 PDS.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	(PED Complete)	CD-2A/B	CD-2C	CD-3A	CD-3B	CD-3C
FY 2009	9/18/2007	2Q FY 2009	3Q FY 2010	N/A	TBD	N/A	N/A	TBD
FY 2010	9/18/2007	9/23/2008	4Q FY 2010	N/A	TBD	N/A	N/A	TBD
FY 2011[a]	9/18/2007	9/23/2008	1Q FY 2011	8/21/2009	4Q FY 2010	8/21/2009	2Q FY 2010	4Q FY 2011

CD-0 – Approve Mission Need

CD-1 – Approve Alternative Selection and Cost Range

CD-2A/2B – Approve Performance Baseline for Building 74 Demolition and Long Lead Procurement; and for Building 74 Modernization and Building 25 Demolition

CD-2C – Approve Performance Baseline for Remainder of Project

CD-3A – Approve Start of Building 74 Demolition and Long Lead Procurement

CD-3B – Approve Start of Construction for Building 74 Modernization and Building 25 Demolition

CD-3C – Approve Start of Construction for Remainder of Project

(fiscal quarter or date)

	CD-4A/B	CD-4C	D&D Start	D&D Complete
FY 2009	TBD	TBD	TBD	TBD
FY 2010	TBD	TBD	TBD	TBD
FY 2011[a]	1Q FY 2013	2Q FY 2015	4Q FY 2010	3Q FY 2014

CD-4A/4B – Complete Building 74 Demolition and Long Lead Procurement, and Approve Start of Operations for Building 74 Modernization and Building 25 Demolition

CD-4C – Approve Start of Operations

D&D Start – Start of Demolition & Decontamination (D&D) work

D&D Complete – Completion of D&D work for Remainder of Project

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[a] This project has not been fully baselined and the schedule is preliminary. Construction funds will not be executed without appropriate CD approvals.

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC[a] Except D&D	OPC, D&D	OPC, Total	TPC
FY 2009	8,680	TBD	TBD	2,300	TBD	TBD	TBD
FY 2010	9,680	TBD	TBD	2,300	TBD	TBD	TBD
FY 2011[b]	9,680	84,920	94,600	2,480	N/A	2,480	97,080

4. Project Description, Justification, and Scope

The objective of this project is to replace seismically unstable, high maintenance facilities at the Lawrence Berkeley National Laboratory (LBNL) with modern, seismically stable, state-of-the-art laboratory space in support of the mission requirements of the Office of Science.

This project includes the modernization of Building 74, including upgrades to building systems and approximately 28,000 to 45,000 gross square feet (GSF) of laboratory/office space; construction of a 35,000 to 43,000 GSF General Purpose Laboratory (GPL); seismic upgrades and slope stabilization for Building 85, the site-wide Hazardous Waste Handling Facility; and demolition of offsetting space. The project includes all necessary design and construction activities and start-up of operations for both the new facility and Building 74.

LBNL is an Office of Science multi-program national laboratory with a mission to perform leading multidisciplinary research in the fields of energy sciences, general sciences, and life sciences. The laboratory's research makes use of multidisciplinary collaboration and advanced engineering, computation, communications, fabrication, and other support facilities characteristic of a national laboratory. The laboratory's facilities are planned, constructed, and maintained to support the research programs and scientific goals, while maintaining compatibility with the university community and the surrounding physical setting. Research at LBNL is directly tied to the quality of its facilities and site improvements through a proactive building and utility maintenance program.

LBNL completed seismic evaluations of all permanently owned and occupied LBNL buildings in FY 2007. These evaluations have revealed that several buildings are seismically unsafe, and would not be able to survive a major earthquake without significant damage to the structure and appreciable life safety hazard to their occupants. The U.S. Geological Survey has estimated the probability of a major seismic event in the San Francisco Bay Area at 67% in the next 30 years. LBNL is located less than one kilometer from the Hayward Fault and will be subjected to severe shaking during a major seismic event on this fault.

This project, through the provision of the new GPL and the upgrades to the existing building systems, will provide safe, modern, and energy efficient laboratories for multidisciplinary biology which directly benefit science at the interface of physical, life, and computational sciences. The research performed in these facilities will support and enhance work conducted at LBNL user facilities including the Advanced Light Source, the National Center for Electron Microscopy, and the Molecular Foundry. Additionally, a number of scientific areas of research will benefit from being co-located as a result of this project.

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[a] Other Project Costs are funded through laboratory overhead.

[b] This project is pre-CD-2. Preliminary cost estimates are shown for TEC and TPC. The TEC range for this project is $91,900,000 to $94,600,000. The TPC range is $94,380,000 to $97,080,000.

FY 2009 and FY 2010 PED funding is being used for design of the project, including project management and all associated support functions. FY 2009 Recovery Act funding will provide for most of Building 74 construction work. FY 2009 appropriated funds were originally forecast to be used for early procurements; however, actual costs are expected to be less than originally estimated. Remaining FY 2009 funds, not used for early procurements, will be used for remaining construction on the project. FY 2010 construction funding is being used to continue construction activities including project management and all associated support functions. FY 2011 funding will be used to continue construction activities.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Total Estimated Costs				
PED[a]				
FY 2009	8,680	8,680	0	2,673
FY 2010	1,000	1,000	0	6,208
FY 2011	0	0	0	799
Total Design	9,680	9,680	0	9,680
Construction				
FY 2009	3,815	3,815	0	0
FY 2009 Recovery	15,000	15,000	1	0
FY 2010	33,027	33,027	5,699	6,517
FY 2011	20,103	20,103	9,300	19,600
FY 2012	12,975	12,975	0	25,012
FY 2013	0	0	0	17,509
FY 2014	0	0	0	1,282
Total Construction	84,920	84,920	15,000	69,920
Total, TEC[b]	94,600	94,600	15,000	79,600

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[a] All design will be completed in less than 18 months.

[b] This project is not yet fully baselined. The TEC range for this project is $91,900,000 to $94,600,000. The TPC range is $94,380,000 to $97,080,000.

(dollars in thousands)

	Appropriations	Obligations	Recovery Act Costs	Costs
Other Project Cost (OPC)[a]				
OPC except D&D				
FY 2008	1,945	1,945	0	1,945
FY 2009	309	309	0	309
FY 2010	2	2	0	2
FY 2011	104	104	0	104
FY 2013	120	120	0	120
Total, OPC	2,480	2,480	0	2,480
Total Project Cost (TPC)				
FY 2008	1,945	1,945	0	1,945
FY 2009	12,804	12,804	0	2,982
FY 2009 Recovery	15,000	15,000	1	0
FY 2010	34,029	34,029	5,699	12,727
FY 2011	20,207	20,207	9,300	20,503
FY 2012	12,975	12,975	0	25,012
FY 2013	120	120	0	17,629
FY 2014	0	0	0	1,282
Total, TPC[b]	97,080	97,080	15,000	82,080

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate[c]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)[d]			
Design	8,311	8,027	N/A
PED Contingency	1,369	1,653	N/A
Total, PED	9,680	9,680	N/A

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[a] Other Project Costs are funded through laboratory overhead.

[b] This project is not yet fully baselined. The TEC range for this project is $91,900,000 to $94,600,000. The TPC range is $94,380,000 to $97,080,000.

[c] Previous estimates shown only included partial funding.

[d] All design will be complete in less than eighteen months.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline
Construction			
Site Preparation	9,394	0	N/A
Other Construction	60,758	43,202	N/A
Construction Contingency	14,768	8,640	N/A
Total Construction	84,920	51,842	N/A
Total TEC[b]	94,600	61,522	N/A
Contingency, TEC	16,137	10,293	N/A
Other Project Cost (OPC)[c]			
OPC except D&D			
Conceptual Planning and Design	2,300	2,142	N/A
Startup and Testing	150	0	N/A
Contingency	30	158	N/A
Total, OPC	2,480	2,300	N/A
Contingency, OPC	30	158	N/A
Total, TPC[c]	97,080	TBD	N/A
Total Contingency	16,167	TBD	N/A

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[a] Previous estimates shown only included partial funding.

[b] This project has not yet received approval of CD-2. The preliminary total estimated cost range for this project is $91,900,000–$94,600,000. The preliminary TPC range is $94,380,000 to $97,080,000.

[c] Other Project Costs are funded through laboratory overhead.

7. Funding Profile History

(dollars in thousands)

Request Year		Prior Years	FY 2009	FY 2009 Recovery Act	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
FY 2009	TEC	0	12,495	0	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	2,250	50	0	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,250	12,545	0	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2010	TEC	0	12,495	15,000	34,027	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	2,250	50	0	0	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,250	12,545	15,000	34,027	TBD	TBD	TBD	TBD	TBD	TBD
FY 2011	TEC	0	12,495	15,000	34,027	20,103	12,975	0	0	0	94,600[a]
	OPC[b]	1,945	309	0	2	104	0	120	0	0	2,480
	TPC	1,945	12,804	15,000	34,029	20,207	12,975	120	0	0	97,080[a]

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	2Q FY 2015
Expected Useful Life (number of years)	30
Expected Future Start of D&D of this capital asset (fiscal quarter)	2Q FY 2045

(Related Funding requirements)

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	640	640	19,203	19,203
Maintenance	1,407	1,407	42,219	42,219
Total, Operations & Maintenance	2,047	2,047	61,422	61,422

9. Required D&D Information

	Square Feet
Area of new construction	35,000–43,000
Area of existing facility(s) being replaced	20,663[c]
Area of additional D&D space to meet the "one-for-one" requirement[d]	14,337–22,337

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[a] This project has not yet received approval of CD-2. The preliminary total estimated cost range for this project is $91,900,000–$94,600,000. The preliminary TPC range is $94,380,000 to $97,080,000.

[b] Other Project Costs are funded through laboratory overhead.

[c] Building 25 (20,303 SF) and Building 25B (360 SF) will be demolished to make way for the new General Purpose Laboratory.

[d] This project includes demolition of appropriate offsetting space to meet this requirement prior to CD-4.

10. Acquisition Approach

A building program and design criteria has been developed by the LBNL Facilities Department incorporating detailed functional requirements for all phases (A, B, and C) of the project. An architect and engineering firm with appropriate multidisciplinary design experience was selected, based on qualifications, for design services. A lump sum Construction Management /General Contracting (CM/GC) subcontract has been negotiated and awarded by the University of California. Independent reviews of the structural design and construction cost estimate have been arranged by LBNL.

Additional specific CD-3A considerations: In order to have the Seismic Phase 2 Building 74 modernization work follow the seismic upgrade work under the Seismic Phase 1 project, the Seismic Phase 1 CM/GC will be used to perform the interior demolition scope of work. The CM/GC will competitively bid this lump sum scope of work. The early procurement of long lead equipment will be competitively bid as a lump sum contract.

Safeguards and Security

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Safeguards and Security			
Protective Forces	33,708	34,567	36,471
Security Systems	7,857	8,347	8,475
Information Security	4,494	4,550	4,141
Cyber Security	18,993	19,824	20,752
Personnel Security	5,517	6,412[a]	7,257[a]
Material Control and Accountability	2,238	2,249	2,413
Program Management	7,796	7,051	6,991
Total, Safeguards and Security	80,603	83,000	86,500

Public Law Authorizations:
Public Law 95–91, "Department of Energy Organization Act", 1977
Public Law 109–58, "Energy Policy Act of 2005"
Public Law 110–69, "America COMPETES Act of 2007"

Program Overview

Mission

The mission of the Office of Science (SC) Safeguards and Security (S&S) program is to support the Departmental research missions at SC laboratories by ensuring appropriate levels of protection against unauthorized access, theft, diversion, loss of custody, destruction of Department assets, or hostile acts that may cause adverse impacts on fundamental science, national security, and the health and safety of DOE and contractor employees, the public, and the environment.

Background

Successfully executing the SC mission requires national and international information sharing and open scientific collaboration. SC laboratories collaborate with universities and research facilities at every corner of the globe through virtual interconnections. Therefore the SC physical and virtual security posture must be flexible and responsive to efforts to functionally integrate international research. In addition, some laboratories must implement security measures to protect classified information, special nuclear material, irreplaceable Departmental property, or shared tools of discovery.

Subprograms

The S&S program functional areas include:

Protective Forces: Security officers/access control officers and security police officers assigned to protect S&S interests.

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[a] For security investigations, FY 2010 includes direct appropriations funding of $184,000 for federal field personnel; an additional estimate of $5,816,000 will be used from chargebacks for contractors. The respective amounts for FY 2011 are $178,000 and $5,822,000.

Security Systems: Personnel, equipment, hardware and software structures, and plans and procedures used to protect S&S interests.

Information Security: Personnel for execution of the administrative policies and procedures for identifying, marking, and protecting classified and sensitive unclassified information and materials from unauthorized disclosure.

Cyber Security: Personnel for protection of computing resources and data against unauthorized access to or modification of information (whether in storage, processing, or transit), as well as ensuring data availability when required for the completion of assigned tasks by Departmental employees.

Personnel Security: Personnel for execution of policies, procedures, processing security clearance applications and activities for granting individuals access to classified matter and/or special nuclear material and allowing Foreign Nationals access to DOE facilities.

Material Control and Accountability: Personnel, systems, and procedures necessary to establish and track nuclear material inventories, control access to and detect loss or diversion of nuclear material.

Program Management: Personnel, policy, oversight, and administration that establish the general requirements for S&S planning associated with the preceding programs. The process also includes reviews of program activities.

Benefits

The S&S program protects DOE assets and resources, thereby allowing the programmatic mission of the Department to be conducted in an environment that is secure and based on the unique needs of each site. The Integrated Safeguards and Security management strategy utilizes a graded approach enabling each facility to design a security protection program that meets facility and science-specific threat scenarios.

Program Planning and Management

S&S planning and management identify the resources necessary to ensure protection of Department assets and identify changes in resource requirements (operational requirements, capital equipment, and general plant projects). Planning and management also entails a review of line item construction projects that directly or indirectly impact risk. The source of directional changes usually comes from revised S&S policy, directives, guidance, or other Departmental requirements. Management and oversight activities include contractor self-assessments and external audits, inspections, surveys, and program reviews conducted by the Department's Inspector General, the Office of Health, Safety and Security, the SC Deputy Director for Field Operations, and the Integrated Support Center. Addressing the results of these oversight activities informs tactical and strategic five-year plans.

Budget Overview

In June 2009, the Office of Health, Safety and Security held a Security Director's Conference which resulted in emerging themes for policy changes within the Department that addressed how policy is developed and implemented. Additionally, plans to manage a revised risk acceptance model, methods the Department can use to change the risk adverse culture, and the role of S&S oversight were overarching topics discussed at this meeting. The Office of the Chief Information Officer also conducted a review of Departmental directives. The resulting recommendation for cyber security was that the Department replace all cyber security related directives with National Institute of Standards and Technology standards. SC has initiated a security industry best practices study. As this study moves forward, adjustments to the functional areas and funding reallocations within the S&S program may be required. The outcome of the best practices study is intended to inform the revision and standardization of baseline requirements across SC, which will clarify minimum standards and codify a set of principles on which future budget requests can be built.

The FY 2011 submission provides direct funding for S&S for the SC base program. Costs of routine security for Work for Others will be provided via full cost recovery. Extraordinary security requirements for the Work for Others projects will be directly charged to customers. Site security activities that pertain to the institutional security requirements will be charged to either indirect or general and administrative costs.

Estimates of Security Cost Recovered by Science, Safeguards and Security

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Safeguards and Security			
Ames National Laboratory	0	0	26
Argonne National Laboratory	0	0	1,044
Brookhaven National Laboratory	0	0	810
Lawrence Berkeley National Laboratory	0	0	932
Pacific Northwest National Laboratory	0	0	1,000
Princeton Plasma Physics Laboratory	0	0	29
Oak Ridge National Laboratory	0	0	3,900
Oak Ridge Institute for Science and Education	0	0	400
SLAC National Accelerator Laboratory	0	0	50
Total, Security Cost Recovered	**0**	**0**	**8,191**

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Ames Laboratory	**1,067**	**980**	**1,007**

Ames Laboratory is operated as an open site and additional access restrictions and protection strategies are applied according to the laboratory's site security plan. The integration of Ames Laboratory with the buildings and activities of Iowa State University has implications for site security planning and site utilization.

Argonne National Laboratory	**9,787**	**8,742**	**8,985**

Argonne National Laboratory has been allocated funding through Environmental Management to begin clean up of a significant quantity of safeguards interests. These interests will require greater levels of protection and material control and accountability during the transition.

Brookhaven National Laboratory	**11,824**	**11,632**	**11,955**

The threat spectrum for Brookhaven National Laboratory is based upon the current DOE Graded Security Protection Policy for DOE programs and facilities as well as other threat/risk assessments conducted by the laboratory and the Federal Bureau of Investigation. In addition, the Suffolk County

(dollars in thousands)

Police Department has identified the laboratory as one of the most likely targets of an attack and includes it on their "Critical Infrastructure List." The laboratory's protection strategies consider the adversary capabilities associated with local threat documents and the site's facility protection categories.

	FY 2009	FY 2010	FY 2011
Chicago Office	**1,222**	**1,222**	**0**

FY 2009 and FY 2010 funding provides for protective force services at Fermi National Accelerator Laboratory which is transferred to Fermi National Accelerator laboratory in FY 2011, consistent with the contract period.

Fermi National Accelerator Laboratory	**2,024**	**2,169**	**3,486**

As a basic science research laboratory facilitating scientific excellence, Fermi National Accelerator Laboratory is engaged in providing unclassified, open, and collaborative work environments.

Lawrence Berkeley National Laboratory	**5,529**	**5,059**	**5,201**

The laboratory serves a large community of continental and intercontinental visitors. Consistent with the terms of the contract with the University of California, no sensitive or classified research is conducted by the laboratory or allowed on-site. S&S funding supports secure but open collaborative efforts on- and off-site.

Oak Ridge Institute for Science and Education	**1,710**	**1,626**	**1,671**

The S&S program implements a comprehensive, graded-approach strategy for the protection of DOE assets. With the exception of three limited security areas which afford protection of classified matter up to and including the Secret Restricted Data level, all the facilities are designated as property protection areas for the purpose of protecting other government owned assets.

Oak Ridge National Laboratory	**9,094**	**8,895**	**9,144**

The S&S budget supports the laboratory in its role as a world leader in scientific research, emerging technologies, and national security research. The site supports research in areas related to detection, inhibition, and response to the use of unconventional weapons and radiation dispersal devices in the United States.

Oak Ridge Office	**19,174**	**19,357**	**19,895**

The Oak Ridge Office oversees and manages S&S programs at the Oak Ridge National Laboratory and the Oak Ridge Site Office. This request primarily provides funding for protective forces for these sites.

Office of Scientific and Technical Information	**583**	**490**	**504**

The Office of Scientific and Technical Information's mission is to collect, preserve, disseminate, and leverage the scientific and technical information resources of DOE. A primary objective is to expand the knowledge base of science and technology and facilitate scientific discovery and application. S&S funding supports classified information protection and unclassified cyber security controls. This request continues to maintain a secure architecture with controls to protect DOE's electronic R&D information.

Pacific Northwest National Laboratory	**11,256**	**11,163**	**11,476**

The laboratory manages an inventory of special nuclear materials and is approved to possess classified matter. The laboratory is a cyber center of excellence for national research and development efforts. Funding for protective force operations is the responsibility of the Office of Environmental

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Management.			
Princeton Plasma Physics Laboratory	**2,242**	**2,178**	**2,237**
Princeton Plasma Physics Laboratory is effectively integrated with the security controls implemented by Princeton University. The laboratory is considered a property protection area. The tritium inventory is located in four areas within a secured perimeter and a restricted access area.			
SLAC National Accelerator Laboratory	**2,679**	**2,643**	**2,716**
The security interests for SLAC include protection of designated property protection areas for people and Departmental property. The remainder of the site is an open extension of the Stanford University campus. Consistent with the terms of the contract with Stanford University, no sensitive or classified research is conducted by SLAC or allowed on-site.			
Thomas Jefferson National Accelerator Facility	**1,504**	**1,432**	**1,470**
Entry to the laboratory is controlled to limit access to individuals who have an official purpose at the research facility. No areas are defined as security areas; security interests are protected by employing logical protection strategies. Unclassified sensitive information requiring protection is controlled by employees who are in possession of the documents or information technology system. High value property is protected by the employee custodian of the property.			
All Other	**908**	**5,412**	**6,753**
All Other supports the continuation and management of a consistent cyber security approach across the Office of Science laboratory complex, Federal security clearances, and program management needs for SC. Funding will be allocated based on the highest priority needs at the conclusion of scheduled programmatic reviews.			
Total, Safeguards and Security	**80,603**	**83,000**	**86,500**

Explanation of Changes

	FY 2011 vs. FY 2010 ($000)
Ames Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+27
Argonne National Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+243
Brookhaven National Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+323

	FY 2011 vs. FY 2010 ($000)
Chicago Office	
Security contract funding is transferred to Fermi National Accelerator Laboratory, consistent with contract.	-1,222
Fermi National Accelerator Laboratory	
Increased funding is provided to support the security contract transfer from the Chicago Office and to ensure a current level of effort.	+1,317
Lawrence Berkeley National Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+142
Oak Ridge Institute for Science and Education	
Increased funding maintains S&S activities at the current level of effort.	+45
Oak Ridge National Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+249
Oak Ridge Office	
Increased funding maintains S&S activities at the current level of effort.	+538
Office of Scientific and Technical Information	
Increased funding maintains S&S activities at the current level of effort.	+14
Pacific Northwest National Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+313
Princeton Plasma Physics Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+59
SLAC National Accelerator Laboratory	
Increased funding maintains S&S activities at the current level of effort.	+73
Thomas Jefferson National Accelerator Facility	
Increased funding maintains S&S activities at the current level of effort.	+38
All Other	
An increase in funding is included for security investigations, and those funds will be distributed upon evaluation of site requirements.	+1,341
Total Funding Change, Safeguards and Security	**+3,500**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	80,581	83,000	86,500
General Plant Projects	22	0	0
Total, Safeguards and Security	80,603	83,000	86,500

Science Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation[a]	FY 2010 Current Appropriation	FY 2011 Request
Science Program Direction				
Salaries and Benefits	133,325	0	146,360	161,643
Travel	3,732	0	4,336	4,919
Support Services	23,904	4,960	16,311	23,667
Other Related Expenses	25,734	640	22,370	24,208
Total, Science Program Direction	186,695	5,600	189,377	214,437
Full Time Equivalents[b]	1,012	0	1,077	1,135

Program Overview

Mission

The mission of the Science Program Direction (SCPD) program is to support and sustain a skilled and motivated Federal workforce that oversees the Office of Science (SC) investments in world-leading scientific research. The SC workforce is responsible for developing and shaping the science program, executing and managing science funding, and overseeing construction of large scientific user facilities. Oversight includes the health and safety of the workforce and overall security requirements. Additionally, the Federal workforce provides administrative, business, legal, and technical management of research grants and contracts, the oversight of the management and operating (M&O) contracts for 10 of the 17 DOE national laboratories, and public access to DOE's research and development (R&D) results.

Background

Carrying out SC's mission—to deliver the scientific discoveries and major scientific tools that transform our understanding of nature and to advance the energy, economic, and national security of the United States—requires not only highly skilled scientific and technical expert program and project managers, but experts in the area of acquisition; finance; legal; construction and infrastructure management; and environment, safety, and health. With growing national challenges in energy, environmental stewardship, and nuclear security, and the need to maintain U.S. innovation and scientific competitiveness, SC continues to be called upon to support world-leading science and research capabilities that will lead to transformational solutions to these challenges and train the next generation of science and engineering leaders in the U.S. Oversight of DOE's basic research portfolio, which includes grants and contracts supporting over 27,000 researchers, as well as oversight of major construction projects, is an exclusively Federal responsibility calling upon a diverse set of knowledge and skills.

SC directly funds, oversees, and manages research programs in condensed matter and materials physics, chemistry, biology, climate and environmental sciences, applied mathematics, computational science, high energy physics, nuclear physics, plasma physics, and fusion energy sciences. SC also provides the nation's researchers with state-of-the-art user facilities—the large machines of modern science. These facilities offer capabilities that are unmatched anywhere in the world and enable U.S. researchers and industries to remain at the forefront of science, technology, and innovation.

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[a] The Recovery Act Current Appropriation column reflects the allocation of funding as of September 30, 2009.

[b] Responsibility for the High Flux Isotope Reactor was transferred in FY 2009 to SC from the Office of Nuclear Energy. Therefore all FY 2009 funding ($899,000) and FTEs (4) are reflected in SC.

With a highly skilled and experienced Federal workforce, SC is able to plan, execute, and manage science programs that meet critical national needs. Specifically:

- The SC Headquarters (HQ) Federal workforce is responsible for oversight of the Federal funds that are awarded to over 300 universities, all 17 DOE national laboratories, and private research institutions. This includes scientific program planning, execution, and management across a broad spectrum of scientific disciplines and program offices and oversight of the design, construction, and operation of large-scale scientific user facilities at laboratories and universities. Program management and oversight includes regular rigorous evaluation of research programs, facilities, and projects by external peer review. Working in collaboration with the laboratory and university communities, the SC HQ Federal staff set the policies and direction for DOE science investment and provides the required Federal oversight.
- SC is responsible for 10 of the 17 DOE national laboratories. Site Office Federal staff, located at each of the 10 SC national laboratories, are responsible for implementing the SC program within the framework established by HQ policy. Site Office staff are also responsible for the day-to-day oversight of $4 billion per year and manage DOE's performance-based M&O contracts for the safe, secure, and effective operation of the laboratories. Site Office staff provide the on-site SC Federal presence with authority encompassing contract management, program and project implementation, and internal operations.
- The Integrated Support Center at the Chicago and Oak Ridge Offices offers administrative, business, legal, and technical support across the entire SC enterprise. These operations include financial management; human resources; grant and contract processing; safety, security, and health management; labor relations, intellectual property and patent management; environmental compliance; infrastructure operations and maintenance; and information systems development and support.
- Federal staff at the Office of Scientific and Technical Information (OSTI) fulfills the Department's legislative mandate to provide public access to the unclassified results of DOE's research programs. OSTI's collection from the mid-1990's to the present is available entirely on line. The transition to a purely digital collection has resulted in significant economies. OSTI also collects, protects, and provides secure access to DOE's classified research outcomes. Recognizing that science research is also performed in other Federal agencies and, indeed, at counterpart organizations around the world, OSTI has built broad collaborations both within the U.S. and internationally to enable a single point of access to nearly 400 million pages of scientific information. Within the U.S., Science.gov offers simultaneous searching of Federal science databases and websites, while WorldWideScience.org performs the same functionality across the R&D results of over 50 countries. By facilitating and accelerating access to such information, SC is accelerating scientific discovery itself.

Benefits

SCPD provides resources necessary for the Office of Science to execute its mission. Maintaining a highly skilled workforce enables the Office of Science to develop and sustain world-class science programs that deliver the scientific discoveries and technological innovations needed to solve our Nation's energy and environmental challenges, and enable the U.S. to maintain its global competitiveness. Providing easy access to scientific findings leverages the Federal science investment and advances the scientific enterprise. With adequate staffing levels and a workforce balanced with appropriate skills, education, and experience, the Office of Science is an effective and efficient steward of taxpayer dollars for maximum national benefit.

Program Planning

The following factors influenced the FY 2011 SCPD budget request:

- *Increased funding for SC research and scientific facilities investment in FY 2009 and FY 2010.* This growth is driven by the increased Federal investment in basic research and research capabilities. The increased SC research, construction, and general plant project funding in FY 2009 and FY 2010 necessarily creates an additional workload on the Federal staff across numerous areas across the SC complex. In FY 2009, grant and contract awards (excluding laboratory field work proposals) increased by 30% over the FY 2008 level, placing significant demands on the current acquisition workforce at HQ and in the field. Increased funding allotments, accelerated execution of those allotments, and the Administration's goal of greater transparency and accountability places greater financial management and oversight responsibilities on program, budget, financial, and accounting offices across the complex. New construction projects and general plant projects will require additional project management, facility, and safety oversight. The plan to double the budget for key research agencies such as the DOE Office of Science will continue to increase the need for effective oversight.
- *Challenges and expectations facing the current SC workforce.* The increased need for highly skilled Federal program and project management requires an SCPD budget that keeps pace with growth in science program funding. However, prior to the FY 2011 budget request, SCPD budgets and workforce have not kept pace with total SC budget increases. From FY 2006 to FY 2010, total SC funding grew at an annualized growth rate of 7.8%; in contrast, SCPD funding only increased at an annualized rate of 4.4% for the same timeframe.
- *Committee of Visitors' (COV) report findings.* SC charges its Federal Advisory Committees every three years to form COVs to externally review its research programs, including how those programs are being managed. Since FY 2002, 17 COV reports have cited the need for additional SC HQ Program Managers and support staff for virtually all research program offices. The HQ Program Manager is responsible for scientific program development, oversight and management, and working in collaboration with the laboratory and university communities. Some reports have noted that staff levels are insufficient for adequate review, oversight, and management of programs.
- *Succession planning across the Office of Science.* The FY 2011 request supports recruitment initiatives, such as local job fairs, Student Career Experience Program, Student Temporary Employment Program, and Intern Programs to attract, keep, and reward the best and brightest—the next generation needed to maintain the U.S. preeminent position in science and technology. These professionals will participate in SC mentorship programs led by high-performing Federal managers. Currently, the average age of SC employees is 51 and 301 employees (31%) are eligible for voluntary retirement in FY 2010; by FY 2011, 321 employees (32%) will be eligible for voluntary retirement.

Budget Overview

The FY 2011 SCPD budget request includes support for salaries and benefits for 1,135 FTEs responsible for executing, managing, and overseeing SC sponsored research programs and providing required oversight. The FY 2011 FTE ceiling includes an increase of 58 FTEs or a 5% increase over the FY 2010 FTE ceiling of 1,077.

The SCPD request also supports travel of SC Federal employees and Advisory Committee members, and support services, including information management systems, grants and contracts management systems, career development related training, and education opportunities.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**133,325**	**146,360**	**161,643**

The SC Federal HQ workforce has a broad range of responsibilities including scientific program planning, execution, and management across a broad spectrum of scientific disciplines and program offices, and oversight of the design, construction, and operation of large-scale scientific user facilities at laboratories and universities. Program management and oversight includes regular rigorous evaluation of research programs, facilities, and projects by external peer review, the majority of which is led by SC Program Managers. SC Program Managers play a central role in the Office of Science's support for world leading research. They represent their programs and the Office of Science in communicating to the scientific community research interests and priorities. They are responsible for selecting appropriate expert peer reviewers and ensuring rigorous merit review of research proposals and evaluation of research programs, and are ultimately responsible for award recommendations informed by peer review. They also have responsibility for maintaining a balanced research portfolio that includes high-risk, high-return research to maximize the Program's potential to achieve mission goals and objectives. Program Managers in the Office of Science are experts in their fields. They stay informed by attending scientific meetings to listen to the cutting edge discussions, communicating with investigators, and staying abreast of the latest scientific and technical literature. Their expertise enables them to recognize new opportunities for quality, cutting-edge research areas important for advancing the scientific fields within their programs. In FY 2009, some 3,500 new and renewal laboratory, university, nonprofit and private industry proposals were awarded, while another 2,500 additional, ongoing awards were managed.

The SC Site Office personnel at SC's 10 national laboratories are the government representatives charged with ensuring mission execution and serve as the government agent in the contractual relationship with the laboratory's operating contractor. These contracts are one of the principal mechanisms utilized to execute the annual budget for the Office of Science to support world-leading science and development and operation of scientific facilities for the Nation. SC and the Department establish plans and expected outcomes for each of the contractors. The SC Site Office personnel responsibilities, many of which are inherently government actions and cannot be performed by contractors, include oversight of contractor activities for the purpose of providing performance evaluation of the contractor, and ensuring timely delivery of Government-furnished services and items, including required Federal approvals and acceptance of contract deliverables and processing of transactions. Contract deliverables and transactions include, but are not limited to, contract funding modifications, reports required by law and statute, program work authorizations, approvals to operate hazardous facilities, leases, property transfers, subcontracts above the Department-authorized thresholds, grants, and activity approvals dictated by law, regulation, and DOE requirements.

These activities are performed by a small number of Federal staff (about 15 to 30 at each site, compared to contractor staffing levels of several thousand in many cases) led by a management representative with the authority to act on the sponsoring programs' behalf, exercising management discretion as appropriate to enable the contractor to deliver on the DOE mission. The manager is supported by Federal contracting officers with the authority and associated warrant to enter the government into binding agreements. The contracting officers are supported by a variety of business specialists who provide accounting, budget, and other business process evaluations and analysis in support of contracting officer decisions and determinations. This is essential given that activities at the laboratories must be conducted on a full cost recovery basis for the government. The site office also has technical staff to evaluate complex, integrated laboratory activities, often including nuclear, radiological, and other complex hazards, as well as qualified Federal project directors to facilitate execution of line item and other construction projects. These technical evaluations inform the government's contractually required evaluation of contractor performance and also provide the basis for acceptance of technical risk by the government.

Effectively supporting the administration of thousands of grants and contracts each year requires a skilled team of Federal staff with procurement, business, legal, and broad range technical expertise. The Integrated Support Center (ISC), comprised of capabilities of both the Chicago and Oak Ridge Offices, provides this support to the SC programs. Likewise, each SC Site Office is supported by the ISC, which is the legal DOE allottee that manages multi-appropriation, multi-program allotments for all of the SC national laboratories. The ISC also holds human resource and real property authorities, and provides additional staff as required to the Site Offices in the areas of information management, environmental safety and health, security, and legal support. The ISC provides support to the SC programs for solicitations and is responsible for the negotiation, award, and administration of contracts and financial assistance awards. The ISC processed well over 4,800 award actions in FY 2009 alone; this number has doubled in the last 7 years.

In FY 2011, funding is requested for 1,135 Federal FTEs for the SC workforce. Funds will support staff with the responsibility for science program development; program and project execution and management; the administrative, business, and technical management of research grants and contracts; oversight of 10 of the 17 DOE national laboratories; and providing public access to the DOE's R&D results.

This requested FTE level, an increase of 58 FTEs from the FY 2010 FTE ceiling, directly responds to the significant increase in workload associated with multi-year funding increases for SC research and scientific facilities, succession planning needs associated with an aging workforce to ensure the next generation of scientific and technical experts are available to maintain the U.S. leadership in science and technology, and is supported and validated by multiple COV reports over the past 7 years.

The 58 additional new FTEs requested in FY 2011 include:

- 22 additional Program Manager and support staff FTEs for the SC HQ program offices to ensure that the necessary resources and infrastructure exist to facilitate sound scientific program development, management, oversight, and reporting of a significantly increased SC research program. These additional FTEs will address staffing concerns cited in 17 COV reports since FY 2002, as well as succession planning and staff development requirements.
- 36 additional staff FTEs across the SC Field complex will ensure that acquisition (grants and contracts), financial, human resources, legal, health, safety, security, facilities management, and other necessary infrastructure is in place to fully support the SC enterprise; ensure contractor oversight; and address succession planning and development.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Travel	**3,732**	**4,336**	**4,919**

Travel includes all transportation, subsistence, and incidental travel expenses of SC's Federal employees and Advisory Committee members in accordance with Federal Travel Regulations. Funding is also included for travel costs associated with permanent changes of station (PCS).

Federal staff travel is required to enable effective management of a broad spectrum of scientific research programs and construction and operation of user facilities, and to perform contractor oversight at geographically dispersed facilities at national laboratories and universities. Management and oversight of research grants across all of the SC research programs requires regular external review, including site visits. Review of large and complex research or facility proposals may also require site visits during the course of the peer review process. In addition, travel by Federal staff is necessary to ensure implementation of DOE orders and regulatory requirements, and includes attendance at site, project, and program reviews; internal audits, compliance reviews, and oversight of investigations and administrative proceedings; and operational policy and process reviews.

Support for travel to meetings, conferences, and training for skill maintenance and/or certification enables the Office of Science to build and maintain the highly technical and skilled workforce that is required.

The request also provides for travel expenses for over 150 members making up the six individual SC Federal Advisory Committees. Committee members consist of representatives from universities, national laboratories, and industry and include a diverse balance of disciplines, experiences, and geography. Each of the six advisory committees meets three to four times annually and provides valuable, independent advice to the Department regarding the complex scientific and technical issues that arise in the planning, management, and implementation of the SC programs.

Support Services	**23,904**	**16,311**	**23,667**

Provides both technical expertise and general administrative services and activities as follows: Maintenance, operation, and cyber security management of SC mission-specific information management systems and infrastructure and SC-corporate Enterprise Architecture and Capital Planning Investment Control management; accessibility to DOE's multi-billion dollar R&D program through E-Gov information systems managed and administered by OSTI; operations and maintenance of the Searchable Field Work Proposal (FWP) system to provide HQ and Field organizations a tool to search, evaluate, and monitor both legacy and current FWPs; day-to-day operations, including mailroom services, travel processing, administration of the Small Business Innovation Research (SBIR) program, grants and contract close-out activities, copy centers, directives coordination, and filing and retrieving records; training and education of Federal staff, including continuing education and career development training; reports or analyses directed toward improving the effectiveness, efficiency, and economy of management and general administrative services; and staffing for 24-hour emergency communications centers and safeguards and security (S&S) oversight functions.

Other Related Expenses	**25,734**	**22,370**	**24,208**

Provides SC's contribution of $8,681,000 to the Department's Working Capital Fund (WCF) for common administrative services at HQ, such as rent and building operations, telecommunications, network connectivity, supplies/equipment, printing/graphics, copying, mail, contract closeout, and purchase card surveillance. In addition, WCF services assessed to and used by HQ, OSTI, and the Field

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

include online training, the Corporate Human Resource Information System, payroll processing, and the Project Management Career Development Program.

Expenses in the Field include fixed requirements associated with rent, utilities, and telecommunications and are paid directly, as are requirements such as building and grounds maintenance, computer/video maintenance and support, printing and graphics, copier leases, site-wide health care units, and equipment.

$750,000 is provided for the Under Secretary of Science to sponsor studies and workshops in furtherance of the role for his Office as defined by the Energy Policy Act of 2005 in 42 USC 7132(b)(4), subparagraphs (A)-(F). These roles include serving as the Science and Technology Advisor to the Secretary, identifying any undesirable duplication or gaps in R&D programs, monitoring the well-being and management of the multipurpose laboratories, examining the effectiveness of grants and other forms of financial assistance, and leading the long-term planning, coordination, and development of a strategic R&D framework for the Department. These responsibilities are not exclusively related to programs within the Office of Science.

Storage of household goods and the buying/selling of homes in conjunction with directed PCS moves are included for HQ and the Field as well as an E-Gov fee for the Integrated Acquisition Environment.

	FY 2009	FY 2010	FY 2011
Total, Science Program Direction	**186,695**	**189,377**	**214,437**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits	
Salaries and Benefits funds current payroll and all other payroll-related expenses across the SC complex for a net increase of 58 FTEs over FY 2010. This assumes a 1.4% pay raise in January 2011 and 4.5% escalation for personnel/pay related activities for employee health insurance and retirement benefits. Effective October 1, 2010 (FY 2011), this also includes an increase for the employing agency contribution of 0.6% for Civil Service Retirement System employees and 0.5% for Federal Employees Retirement System employees.	+15,283
Travel	
This increase provides support for travel requirements related to additional Program Managers and increased program management oversight of a significantly increased SC research portfolio at HQ (+$175,000); increased travel requirements by technical and administrative staff supporting acquisitions, finance, ES&H, and training certifications and qualifications (+$360,000); and 1.1% escalation (+$48,000) for non-pay activities.	+583

	FY 2011 vs. FY 2010 ($000)
Support Services	
FY 2010 expenses at Headquarters and OSTI for the maintenance and operation of SC mission-specific IT systems and support, day-to-day operation of the HQ mailroom and travel processing office, and administration of the DOE Small Business Innovative Research (SBIR) program are being partially supported using prior year balances. $2,275,000 of the increase in FY 2011 supports maintaining a constant level of effort in these areas. Training will be increased $239,000, consistent with additional planned new hires and emphasis on career development, and $96,000 of the increase at Headquarters/OSTI is related to escalation.	
As at Headquarters, FY 2010 expenses in the field for support services including technical support for Documented Safety Analyses and occupational medicine, S&S oversight services, safety related projects, health physics, emergency operations, criticality support, financial reviews of SBIR proposals, statistical support, and administrative support such as mail and file services and security processing/declassification, and maintenance and operation of SC mission-specific IT systems and support are being partially supported using prior year balances. $4,473,000 of the increase in FY 2011 supports maintaining a constant level of effort in these areas. Training will be increased $190,000, consistent with additional planned new hires and emphasis on career development, and $83,000 of the increase in the field is related to escalation.	+7,356
Other Related Expenses	
FY 2010 expenses at Headquarters for other services and IT software and hardware requirements are being partially supported using prior year balances. $652,000 of the increase in FY 2011 supports maintaining a constant level of effort in these areas. $750,000 of the increase supports activities by the Under Secretary of Science as defined by the Energy Policy Act of 2005. $232,000 of the increase is related to the SC Working Capital Fund contribution due to increases for rent, building operations, utilities, communications, and additional FY 2011 new hires and $141,000 of the increase is related to escalation.	
In the field, FY 2010 expenses for other services and fixed requirements such as building operations, utilities, communications are being partially supported using prior year balances. $63,000 of the increase in FY 2011 supports maintaining a constant level of effort in these areas.	+1,838
Total Funding Change, Science Program Direction	**+25,060**

Supporting Information

Operating Expenses, Capital Equipment and Construction Summary

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operating Expenses	186,695	189,377	214,437

Funding Profile by Category by Site

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Headquarters			
Salaries and Benefits	43,391	52,709	60,207
Travel	2,198	2,876	2,968
Support Services	7,213	7,926	10,332
Other Related Expenses	14,986[a]	11,750	13,729
Total, Headquarters	67,788	75,261	87,236
Full Time Equivalents	279	352	374
Office of Scientific and Technical Information			
Salaries and Benefits	6,226	6,904	6,953
Travel	90	86	84
Support Services	1,573	859	1,063
Other Related Expenses	1,264	1,067	863
Total, Office of Scientific and Technical Information	9,153	8,916	8,963
Full Time Equivalents	58	57	57
Field Offices			
Chicago Office			
Salaries and Benefits	23,604	24,180	26,855
Travel	380	365	525
Support Services	3,152	2,052	4,483
Other Related Expenses	2,835	2,495	1,697
Total, Chicago Office	29,971	29,092	33,560
Full Time Equivalents	193	190	204

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[a] In FY 2009, the OSTI WCF activity ($41,000) is included in Headquarters. The FY 2010 ($41,000) and FY 2011 ($43,000) amounts are included in OSTI.

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Oak Ridge Office			
Salaries and Benefits	28,404	28,217	30,655
Travel	403	360	536
Support Services	9,396	3,449	6,163
Other Related Expenses	5,280	5,808	4,903
Total, Oak Ridge Office	43,483	37,834	42,257
Full Time Equivalents	262	247	260
Ames Site Office			
Salaries and Benefits	517	561	609
Travel	18	22	12
Support Services	1	2	0
Total, Ames Site Office	536	585	621
Full Time Equivalents	4	4	4
Argonne Site Office			
Salaries and Benefits	3,075	3,418	4,138
Travel	76	0	55
Support Services	15	0	115
Total, Argonne Site Office	3,166	3,418	4,308
Full Time Equivalents	21	23	26
Berkeley Site Office			
Salaries and Benefits	3,485	4,032	4,272
Travel	68	80	89
Support Services	62	250	105
Other Related Expenses	70	100	120
Total, Berkeley Site Office	3,685	4,462	4,586
Full Time Equivalents	23	25	24

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Brookhaven Site Office			
Salaries and Benefits	3,883	4,370	4,631
Travel	36	110	110
Support Services	6	363	354
Other Related Expenses	5	277	350
Total, Brookhaven Site Office	3,930	5,120	5,445
Full Time Equivalents	25	27	28
Fermi Site Office			
Salaries and Benefits	2,092	2,326	2,597
Travel	19	9	63
Support Services	1	8	40
Other Related Expenses	0	20	0
Total, Fermi Site Office	2,112	2,363	2,700
Full Time Equivalents	15	16	17
New Brunswick Laboratory			
Salaries and Benefits	3,774	4,128	4,462
Travel	87	92	75
Support Services	1,349	1,145	509
Other Related Expenses	922	767	1,969
Total, New Brunswick Laboratory	6,132	6,132	7,015
Full Time Equivalents	27	30	33
Oak Ridge National Laboratory Site Office			
Salaries and Benefits	3,893	4,076	4,354
Travel	63	70	42
Support Services	551	161	22
Other Related Expenses	58	50	39
Total, Oak Ridge National Laboratory Site Office	4,565	4,357	4,457
Full Time Equivalents	30	30	32

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Pacific Northwest Site Office			
Salaries and Benefits	4,970	5,014	5,450
Travel	143	147	172
Support Services	277	67	221
Other Related Expenses	174	36	330
Total, Pacific Northwest Site Office	5,564	5,264	6,173
Full Time Equivalents	34	35	36
Princeton Site Office			
Salaries and Benefits	1,728	1,805	1,920
Travel	4	0	46
Support Services	2	0	12
Other Related Expenses	0	0	80
Total, Princeton Site Office	1,734	1,805	2,058
Full Time Equivalents	12	12	12
SLAC Site Office			
Salaries and Benefits	2,524	2,672	2,476
Travel	63	52	60
Support Services	301	24	220
Other Related Expenses	60	0	73
Total, SLAC Site Office	2,948	2,748	2,829
Full Time Equivalents	16	16	15
Thomas Jefferson Site Office			
Salaries and Benefits	1,759	1,948	2,064
Travel	84	67	82
Support Services	5	5	28
Other Related Expenses	80	0	55
Total, Thomas Jefferson Site Office	1,928	2,020	2,229
Full Time Equivalents	13	13	13

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Total Field Offices			
Salaries and Benefits	83,708	86,747	94,483
Travel	1,444	1,374	1,867
Support Services	15,118	7,526	12,272
Other Related Expenses	9,484	9,553	9,616
Total, Field Offices	109,754	105,200	118,238
Full Time Equivalents	675	668	704
Total SCPD			
Salaries and Benefits	133,325	146,360	161,643
Travel	3,732	4,336	4,919
Support Services	23,904	16,311	23,667
Other Related Expenses	25,734	22,370	24,208
Total, SCPD	186,695	189,377	214,437
Full Time Equivalents[a]	1,012	1,077	1,135

Support Services by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Technical Support			
Development of Specifications	360	140	146
System Definition	250	110	162
System Review and Reliability Analyses	750	400	510
Surveys or Reviews of Technical Operations	2,028	1,121	161
Total, Technical Support	3,388	1,771	979

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[a] Responsibility for the High Flux Isotope Reactor (HFIR) was transferred in FY 2009 to SC from the former Office of Nuclear Energy (NE). Therefore all FY 2009 funding ($899,000) and FTEs (4) are reflected in SC.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Management Support			
Automated Data Processing	10,878	6,292	10,465
Training and Education	806	929	1,352
Analyses of DOE Management Processes	0	86	0
Reports and Analyses, Management, and General Administrative Services	8,832	7,233	10,871
Total, Management Support	20,516	14,540	22,688
Total, Support Services	23,904	16,311	23,667

Other Related Expenses by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Rent to GSA	808	837	825
Rent to Others	1,365	1,737	100
Communications, Utilities, and Miscellaneous	1,776	1,596	2,151
Printing and Reproduction	40	35	73
Other Services	3,237	3,517	7,221
Operation and Maintenance of Equipment	1,123	1,358	99
Operation and Maintenance of Facilities	1,989	1,835	2,042
Supplies and Materials	1,540	1,241	738
Equipment	1,571	1,747	2,278
Working Capital Fund	12,285	8,467	8,681
Total, Other Related Expenses	25,734	22,370	24,208

Congressionally Directed Projects

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Congressionally Directed Projects			
Congressionally Directed Projects	91,064	74,737	0
SBIR/STTR	0	2,153	0
Total, Congressionally Directed Projects	91,064[a]	76,890	0

Description

The Energy and Water Development and Related Agencies Appropriations Act, 2010 included 76 congressionally directed projects within the Office of Science. Funding for these projects was appropriated as a separate funding line although specific projects may relate to ongoing work in other programmatic areas.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Congressionally Directed Projects			
▪ Advanced Artificial Science and Engineering Research Infrastructure (TX)	370	292	0
▪ Advanced Manufacturing and Engineering Equipment (IN)	0	972	0
▪ Alaska Climate Center (AK)	0	972	0
▪ Algae to Biodiesel, Carlsbad (NM)	0	729	0
▪ Alvernia College Scientific Instrumentation Initiative (PA)	555	0	0
▪ Antibodies Research, University of North Dakota (ND)	2,544	2,916	0
▪ Applied Biomechanical Engineering Graduate Program (IN)	0	388	0
▪ Barry University Institute for Collaborative Sciences Research (FL)	740	0	0
▪ Bethune-Cookman University STEM Research Lab (FL)	0	243	0
▪ Bionanotechnology: Research and Commercialization, Louisiana Tech University, Ruston (LA)	1,387	0	0
▪ Biotechnology/Forensics Laboratory (UT)	462	0	0
▪ Brown University, Brown Energy Initiative (RI)	925	0	0

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[a] Total is reduced by $2,623,225: $2,342,165 of which was transferred to the Small Business Innovative Research (SBIR) program and $281,060 of which was transferred to the Small Business Technology Transfer (STTR) program.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ Building Surface Science Capacity to Serve the Automobile Industry in Southeastern Michigan (MI)	0	486	0
▪ California State University, San Bernardino Twin Tower Project (CA)	555	0	0
▪ Carbon Nanotube Technology Center (CANTEC) (OK)	0	972	0
▪ Center for Advanced Bio-Based Binders (CABB) and Pollution Reduction Technologies (IA)	0	923	0
▪ Center for Advanced Scientific Computing and Modeling (CASCAM) (TX)	681	680	0
▪ Center for Catalysis and Surface Science At Northwestern University (IL)	925	0	0
▪ Center for Diagnostic Nanosystems, Marshall University, Huntington (WV)	1,850	2,916	0
▪ Center for Nanomedicine and Cellular Delivery, School of Pharmacy, University of Maryland, Baltimore (MD)	694	486	0
▪ Center for Sustainable Energy at Bronx Community College, Bronx, NY (NY)	462	486	0
▪ Center of Excellence and Hazardous Materials, Carlsbad (NM)	1,850	0	0
▪ Chemistry Building Renovation (MI)	462	0	0
▪ Clean Energy Infrastructure Educational Initiative (OH)	0	486	0
▪ Clean Energy Storage, Conversion, and Generation Research (IL)	0	486	0
▪ Clemson University Cyberinstitute (SC)	1,387	486	0
▪ Climate Change Modeling Capability, Los Alamos National Laboratory, Los Alamos (NM)	4,625	0	0
▪ Climate Model Evaluation Program (AL)	0	1,750	0
▪ Clinton Junior College Science Program (SC)	370	0	0
▪ Collaborative Initiative in Biomedical Imaging, University of North Carolina (NC)	1,387	0	0
▪ College of Saint Elizabeth (NJ)	0	972	0
▪ Computational Modeling of Drug-Resistant Bacteria (TN)	0	889	0
▪ Computing Capability (ND)	0	4,860	0
▪ Contrast Media and Wound Closure Reduction Study, University of Mississippi (MS)	601	0	0
▪ Curriculum and Infrastructure Enhancement in STEM (PA)	462	0	0

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ Decision Support Tools for Complex Analysis (DSTCA) (OH)	1,387	0	0
▪ Development of Ultrafiltration Membrane-Separation Technology for Energy-Efficient Water Treatment (NV)	0	777	0
▪ Eastern Kentucky University Equipment for New Science Building (KY)	925	0	0
▪ Energy Efficiency & Water Institute Research Facility, Purdue University-Calumet (IN)	925	1,944	0
▪ Energy Systems Engineering Institute (PA)	0	486	0
▪ Enhancement for the Intermountain Center for River Restoration and Rehabilitation (UT)	0	583	0
▪ Environmental Quality Monitoring and Analysis (IL)	0	486	0
▪ Facilitating Blood-Brain Barrier Research, Seattle Science Foundation, Seattle (WA)	1,387	0	0
▪ Former Workers Medical Surveillance Programs, State University of Iowa, Iowa City (IA)	925	0	0
▪ Fourier Transform Nuclear Magnetic Resonance (FTNMR) Spectrometer (NY)	0	486	0
▪ Fuel Cell Research, Brown University (RI)	0	1,458	0
▪ Functional MRI Science Research, University of Vermont College of Medicine, Burlington (VT)	1,156	1,166	0
▪ Fusion Energy Spheromak Turbulent Plasma Experiment (STPX) (FL)	925	486	0
▪ George Mason University—National Center for Biodefense and Infectious Disease (VA)	1,387	0	0
▪ Green Manufacturing and Energy Conscious Design Program (MI)	0	972	0
▪ Hofstra University Center for Climate Study (NY)	462	0	0
▪ Idaho Accelerator Center Production of Medical Isotopes (ID)	925	1,458	0
▪ Idaho National Laboratory Center for Advanced Energy Studies (ID)	2,429	972	0
▪ Institute for Collaborative Sciences Research (FL)	0	1,166	0
▪ Institute for Integrated Sciences at Boston College (MA)	2,312	1,944	0
▪ Instrumentation and Construction Costs for Three Student Independent Research Labs Dedicated to Biology, Chemistry and Biochemistry, and Physics at Albright College in Reading (PA)	370	0	0

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ Intermountain Center for River Restoration and Rehabilitation, Utah State University, Logan (UT)	555	0	0
▪ Kansas University Cancer Research Equipment (KS)	0	3,888	0
▪ Landfill Leachate Recirculation and Gas to Energy Project (NC)	0	486	0
▪ Large Scale Application of Single-Walled Carbon Nanotubes, University of Oklahoma in Norman Oklahoma (OK)	925	0	0
▪ Luther College Science Building, Renovation Project (IA)	925	0	0
▪ Marine Systems Energy/Environmental Sustainability Research (MA)	0	292	0
▪ Marine Systems Research, University of Massachusetts at Boston (MA)	462	0	0
▪ Martin County Microfiber Hydrogen Fuel Cell Technology Development (NC)	0	972	0
▪ Marygrove College Matters (MI)	185	0	0
▪ Material Science Smart Coatings (NE)	0	486	0
▪ Materials and Energy Research Development, Tulane University, New Orleans (LA)	925	0	0
▪ Matter-Radiation Interactions in Extremes, Los Alamos National Laboratory, Los Alamos (NM)	6,474	0	0
▪ Mental Illness and Neuroscience Discovery (MIND) Institute (NM)	11,099	0	0
▪ Meteorology and Atmospheric Science Program at the University of Louisville (KY)	0	340	0
▪ Michigan Geological Carbon Sequestration Research and Education Program (MI)	601	0	0
▪ Nanotechnology Initiative (CT)	0	729	0
▪ National Biorepository—Nationwide Children's Hospital (OH)	694	0	0
▪ Neuroscience Research, Dominican University, River Forest (IL)	462	0	0
▪ Nevada Water Resources Data, Modeling, and Visualization (DMV) Center (NV)	0	729	0
▪ Next Generation Neuroimaging at Cleveland Clinic (OH)	462	0	0
▪ North Dakota State University Computing Capability, Fargo (ND)	5,550	0	0

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ Notre Dame Innovation Park, South Bend (IN)	0	559	0
▪ Performance Assessment Institute (NV)	0	972	0
▪ Physical and Biological Sciences Laboratory Learning Center (FL)	0	389	0
▪ Pioneer Valley Life Science Institute Translational Biomedical Research (MA)	462	389	0
▪ Professional Science Master's Advanced Energy and Fuels Management Program (IL)	416	0	0
▪ Rapid Detection of Contaminants in Water Supplies Using Magnetic Resonance and Nanoparticles (MA)	1,387	0	0
▪ Regenerative Medicine (IL)	462	0	0
▪ Renovation and Development of the Louisiana State University Nuclear Science Building (LA)	0	972	0
▪ Research into Proton Beam Therapy, Seattle Cancer Care Alliance, Seattle (WA)	1,387	0	0
▪ Ribonucleic Acid Interference Research (RNAi) (MA)	925	292	0
▪ Rockland Community College Science Lab Upgrade (NY)	0	292	0
▪ Sandia Nanotechnology Engineering Center, Sandia National Laboratory, Albuquerque (NM)	4,625	0	0
▪ Scanning Near-Field Ultrasound Holography (SNFUH) Instrumentation for Non-Invasive And Non-Destructive Imaging of Nanoparticle Interaction with Cells (IL)	925	0	0
▪ Science Center Equipment and Energy Efficient LEED Technology (UT)	0	875	0
▪ Science Education Facility Renovations, Ohio Christian University (OH)	925	0	0
▪ Science Lab Expansion (NY)	0	535	0
▪ Science, Math, and Technology Education Initiative, College of St. Elizabeth (NJ)	462	0	0
▪ Single Photon Emission Computed Tomography (SPECT) Imaging Instrumentation Research Initiative (IL)	925	0	0
▪ Smart Grid Communications Security Project (CO)	0	972	0
▪ Smart Grid Simulation Laboratory (CO)	0	875	0
▪ Southern Methodist University Advanced Parallel Processing Center (TX)	925	0	0

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ Southern Utah University Science Center Energy Efficiency Modernization and Enhancement Project (UT)	0	972	0
▪ St. Thomas University—Community Outreach, Research and Training Endeavor (FL)	555	0	0
▪ State-of-the-Art Large-Scale Testing for Wind to Enhance Infrastructure Resiliency and Develop Energy-Efficient Buildings (FL)	0	972	0
▪ STEM Infrastructure Improvement Project (SC)	0	1,458	0
▪ STEM Minority Graduate Program (PA)	0	4,374	0
▪ Supercapacitors (NY)	1,387	0	0
▪ Susquehanna University, Equipment for New Science Center (PA)	0	972	0
▪ Sustainable Biofuels Development Center (CO)	1,387	486	0
▪ Targeted Radiotherapy for Melanoma (MA)	0	292	0
▪ Technology Transfer & Commercialization of Technologies at DOE Laboratories (NM)	0	729	0
▪ The National Energy Policy Institute, University of Tulsa (OK)	694	0	0
▪ The New School Green Building (NY)	0	972	0
▪ Transylvania University Brown Science Center Equipment (KY)	0	632	0
▪ Twin Tower Observatory (CA)	0	194	0
▪ Ultra Fast Power Processor for Smart Grid (CA)	0	972	0
▪ Ultra-Dense Porphyrim-Based Capacity Molecular Memory For Supercomputing (CO)	925	0	0
▪ Unique Methodologies for Nano/Micro Manufacturing and Job Training for Nanotechnology (IL)	0	486	0
▪ University of Delaware Energy Institute (DE)	0	486	0
▪ University of Illinois at Chicago High Performance Computing (IL)	0	972	0
▪ University of Massachusetts Integrative Science Building (MA)	1,850	1,944	0
▪ University of the Cumberlands Science and Technology Complex (KY)	925	0	0
▪ University of Rhode Island Cyberinfrastructure (RI)	925	0	0

(dollars in thousands)	FY 2009	FY 2010	FY 2011
▪ University of Rhode Island Regional Earth Systems Institute (RI)	0	729	0
▪ University of South Dakota Catalysis Group for Alternative Energy (SD)	0	1,069	0
▪ University of Tulsa Algae to Green Fuels Energy Project (OK)	0	729	0
▪ University Park and Research Center in Chula Vista, (CA)	0	972	0
▪ Whittier College Science and Mathematics Initiative (CA)	462	0	0
▪ Whitworth University STEM Equipment (WA)	0	292	0
▪ Yttrium-90 Microspheres Research (WA)	0	1,215	0
Total, Congressionally Directed Projects	91,064	74,737	0
SBIR/STTR	**0**	**2,153**	**0**

In FY 2009, $2,342,165 and $281,060 were transferred to the SBIR and STTR programs, respectively. FY 2010 amount shown is the estimated requirement for continuation of the SBIR and STTR programs that are mandated by Congress.

	FY 2009	FY 2010	FY 2011
Total, Congressionally Directed Projects	**91,064**	**76,890**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Congressionally Directed Projects	
No funding requested	-74,737
SBIR/STTR	
No funding requested	-2,153
Total Funding Change, Congressionally Directed Projects	**-76,890**

Isotope Production and Distribution Program Fund

Program Overview

The Department of Energy's Isotope Program produces and sells radioactive and stable isotopes, byproducts, surplus materials, and related isotope services world-wide, and operates under a revolving fund established by the 1990 Energy and Water Appropriations Act (Public Law 101–101), as modified by Public Law 103–316. The combination of an annual direct appropriation and cash collections/advance payments from isotope sales are deposited in the Isotope Production and Distribution Program Fund, the revolving fund. This revolving fund allows continuous and smooth operations of isotope production, sales, and distribution when there are fluctuations in the federal budget cycle and sales. The fund's revenues and expenses are audited annually consistent with Government Auditing Standards and other relevant laws, such as the Chief Financial Officers Act of 1990 and the Government Performance and Results Act of 1993.

The Program's fiscal year appropriation is received via transfer from the Office of Science's Nuclear Physics program (see the Isotope Development and Production for Research and Applications section of the Nuclear Physics program within the Office of Science appropriation). Appropriated funds are used to support the scientists and engineers needed to carry out the Isotope Program and to operate and maintain isotope facilities to assure reliable production. In addition, the appropriation provides support for R&D activities associated with the development of new production and processing techniques for isotopes, operations support for the production of research isotopes, and support for the training of new personnel in isotope production and development. Each of the sites' production expenses for processing and distributing isotopes is offset by revenue generated from sales. The combination of appropriated funds and sales from revenue maintain the financial viability of the program. Of the total resources available annually in the revolving fund, about 75 percent is used for operations, maintenance, and isotope production, with roughly 25 percent available for process improvements, unanticipated changes in volume, and purchases of small capital equipment, such as assay equipment and shipping containers needed to ensure on-time deliveries.

Isotopes are currently produced and processed at three facilities which are stewarded by the Isotope Program: the Isotope Production Facility at Los Alamos National Laboratory, the Brookhaven Linac Isotope Production Facility at Brookhaven National Laboratory, and processing facilities at Oak Ridge National Laboratory. In addition, the Isotope Program is planning to use the recently installed hydraulic tube at the Advanced Test Reactor at the Idaho National Laboratory for radioisotope production. This upgrade will provide additional capability to produce short-lived medical and scientific research isotopes in short supply. At the Pacific Northwest National Laboratory (PNNL), the isotope program will continue to distribute strontium-90, a byproduct material of the past weapons programs, and will consider processing other byproduct material stored at PNNL. Starting in FY 2010, the Isotope Program will increase productivity by broadening its suite of facilities to include university accelerator and reactor facilities and other Federal agency facilities which can provide cost-effective and unique capabilities; these include cyclotron facilities at the National Institutes of Health, the Washington University cyclotron, the University of California at Davis cyclotron, and the Missouri University Research Reactor.

Background

The Department has supplied isotopes and related services for more than 50 years. These isotope products and services are used by medical institutions, universities, research organizations, and industry for a wide array of uses and applications. Isotopes are also provided to many Federal agencies, either directly or indirectly, including the National Institutes of Health and its grantees, the Environmental Protection Agency, and the Department of Homeland Security.

As the range of available isotopes and the recognized uses for them increased, new or improved isotope products contributed to progress in medical research and treatment, new industrial processes, and scientific investigation. Substantial national and international infrastructure has been built around the use of isotopes and is dependent on the Department's products and services. Isotopes are now used for hundreds of research, biomedical, homeland security, and industrial applications that benefit society every day, including heart imaging, cancer therapy, smoke detectors, neutron detectors, explosives detection, oil exploration, and tracers for climate change.

Isotope applications are widely used in medical research, diagnosis, and therapies, which are a growing component of the U.S. health care system. It is estimated that the treatment of one in every three people at a hospital makes use of a radioisotope in laboratory tests, diagnoses, or therapy. Each day, over 40,000 medical patients receive nuclear medicine procedures in the United States. Such nuclear procedures are among the safest diagnostic tests available. They enhance patient care by avoiding exploratory surgery and similar procedures. For example, it has been demonstrated that the use of myocardial perfusion imaging in emergency room chest pain centers can reduce the duration of stay on average from 46 hours to 12 hours. Adequate supplies of medical and research isotopes are essential to the Nation's health care system and to basic research and industrial applications that contribute to national economic competitiveness.

Isotope uses in homeland security applications are also increasing and include radiation portal monitors used to find unshielded or lightly shielded radiological material, imaging systems used to find densely shielded material, systems to detect the presence of nitrogen-based chemical explosives, and other forms of explosives detection.

The total budgetary resources available in the revolving fund in FY 2009 were $59.2 million. This consisted of $24.8 million from the FY 2009 direct Nuclear Physics appropriation, $14.8 million from the Recovery Act, and collections of $19.6 million, which were used to cover expenses, support research into alternative production and processing techniques, and develop new production capabilities. Collections increase or decrease depending on customer demand, production efficiencies, and the availability of facilities. The collections for FY 2009 represent a modest increase over recent years, reflecting an increase in sales and production output due to californium-252, helium-3, and strontium-82. For example, the program received advance payments from californium-252 customers to ensure a long-term production capability of this critical isotope. Californium-252 has a variety of industrial and medical applications. Strontium-82 has gained world-wide acceptance for use in heart imaging which has resulted in increased sales over the last several years. Helium-3 sales also increased due to its use in neutron detectors. Sales are not static; they can fluctuate significantly on a monthly basis, presenting a challenge for managing a productive and optimized core staff.

In FY 2009, the Isotope Program served over 170 customers including major pharmaceutical companies, industrial users, and over a hundred researchers at hospitals, national laboratories, universities, and private companies. There are ten high-volume and low unit cost isotopes among the many produced by the Program; the remaining isotopes are low-volume research isotopes and thus more expensive to produce. Progress has been made in the past year in evaluating the pricing of isotopes in an effort to make research isotopes more affordable; these efforts are continuing. In FY 2010 and FY 2011, commercial isotopes will continue to be priced to recover full cost. Research isotopes will be provided at a reduced price that will provide reasonable compensation to the government while encouraging research and development. For example, some expenses that were paid traditionally by the researcher are now being supported with appropriated funds, reducing the price of the research isotope to the customer. Improved communication with the user community and federal agencies has improved the ability to forecast demand of needed isotopes, which poises the Isotope Program to better meet the projected needs of the community, resulting in a more reliable supply of research isotopes.

Of the isotopes produced by the Isotopes Program, about 60% are for medical research and applications, 20% are for commercial use, and 20% are for other research. A total of about 570 shipments were made in FY 2009, of which 29% were foreign and 5% were intra-governmental, with the remainder being for other domestic needs. Customer satisfaction with product specifications continues to be high with 99.7% of products and services provided meeting the terms of the contract/sales order.

Selected FY 2009 Accomplishments

- As a result of growing demand for selenium-75, a total of 30 targets irradiated in the High Flux Isotope Reactor, amounting to approximately 27,500 curies of high specific activity (about 6,500 curies per gram) selenium-75, were processed and shipped in FY 2009. This allowed the manufacturers to produce and distribute over 300 commercial gamma radiography sources for non-destructive quality testing applications. The source applications include quality verification of welds in oil and gas pipelines, pressure vessels (boilers), and shipbuilding.
- The Nuclear Physics program facilitated the formation of a federal working group on the helium-3 supply issue involving staff from Nuclear Physics, NNSA, the Department of Homeland Security, and the Department of Defense. This working group will ensure that the limited supply of helium-3 will be distributed to the highest priority applications and basic research. Helium-3 is used in neutron detectors for national security, nonproliferation, defense, border security, and homeland security applications.
- After many discussions with the californium-252 source manufacturers and users, and bottoms-up evaluation of the californium-252 costs associated with production, the Nuclear Physics program resolved production issues and a four-year contract was signed with the source manufacturers to continue californium-252 production and ensure its availability in the outyears. Californium-252 is used for medicine, research, nuclear fuels, mining and cement manufacturing, and homeland and national security. This isotope is available only in the U.S. and Russia.

Budget Overview

For FY 2011 and the future, the Department foresees more than moderate growth in isotope demand, coupled with the possible need for new isotope products for homeland security, medicine, and industry. In order to satisfy the needs of its customers, the program seeks to meet supply requirements for year-round availability of isotopes for scientific and medical research and, in particular, for human clinical trials. The program's production capability may be called upon for initial ramp-up of production of major new isotope products until market forces bring in private producers that are willing to invest and produce the needed isotopes.

GENERAL PROVISIONS

[SEC. 301. None of the funds appropriated by this Act may be used to prepare or initiate Requests For Proposals (RFPs) for a program if the program has not been funded by Congress.]

[SEC. 302. None of the funds appropriated by this Act may be used—

(1) to augment the funds made available for obligation by this Act for severance payments and other benefits and community assistance grants under section 4604 of the Atomic Energy Defense Act (50 U.S.C. 2704) unless the Department of Energy submits a reprogramming request to the appropriate congressional committees; or

(2) to provide enhanced severance payments or other benefits for employees of the Department of Energy under such section; or

(3) develop or implement a workforce restructuring plan that covers employees of the Department of Energy.]

SEC. [303]*301*. The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. [304]*302*. None of the funds in this or any other Act for the Administrator of the Bonneville Power Administration may be used to enter into any agreement to perform energy efficiency services outside the legally defined Bonneville service territory, with the exception of services provided internationally, including services provided on a reimbursable basis, unless the Administrator certifies in advance that such services are not available from private sector businesses.

SEC. [305]*303*. When the Department of Energy makes a user facility available to universities or other potential users, or seeks input from universities or other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users. When the Department of Energy considers the participation of a university or other potential user as a formal partner in the establishment or operation of a user facility, the Department shall employ full and open competition in selecting such a partner. For purposes of this section, the term "user facility" includes, but is not limited to:

(1) a user facility as described in section 2203(a)(2) of the Energy Policy Act of 1992 (42 U.S.C. 13503(a)(2));

(2) a National Nuclear Security Administration Defense Programs Technology Deployment Center/User Facility; and

(3) any other Departmental facility designated by the Department as a user facility.

SEC. [306]*304*. Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 414) during fiscal year [2010] *2011* until the enactment of the Intelligence Authorization Act for fiscal year [2010] *2011*.

SEC. [307]*305*. Of the funds made available by the Department of Energy for activities at Government-owned, contractor-operated laboratories funded in this Act or subsequent Energy and

Water Development Appropriations Acts, the Secretary may authorize a specific amount, not to exceed 8 percent of such funds, to be used by such laboratories for laboratory directed research and development: *Provided*, That the Secretary may also authorize a specific amount not to exceed 4 percent of such funds, to be used by the plant manager of a covered nuclear weapons production plant or the manager of the Nevada Site Office for plant or site directed research and development.

SEC. [308]*306*. (a) In any fiscal year in which the Secretary of Energy determines that additional funds are needed to reimburse the costs of defined benefit pension plans for contractor employees, the Secretary may transfer not more than 1 percent from each appropriation made available in this and subsequent Energy and Water Development Appropriation Acts to any other appropriation available to the Secretary in the same Act for such reimbursements.

[(b) Where the Secretary recovers the costs of defined benefit pension plans for contractor employees through charges for the indirect costs of research and activities at facilities of the Department of Energy, if the indirect costs attributable to defined benefit pension plan costs in a fiscal year are more than charges in fiscal year 2008, the Secretary shall carry out a transfer of funds under this section.]

([c]*b*) In carrying out a transfer under this section, the Secretary shall use each appropriation made available to the Department in that fiscal year as a source or the transfer, and shall reduce each appropriation by an equal percentage, except that appropriations for which the Secretary determines there exists a need for additional funds for pension plan costs in that fiscal year, as well as appropriations made available for the Power Marketing Administrations, the title XVII loan guarantee program, and the Federal Energy Regulatory Commission, shall not be subject to this requirement.

([d]*c*) Each January, the Secretary shall report to the Committees on Appropriations of the House of Representatives and the Senate on the state of defined benefit pension plan liabilities in the Department for the preceding year.

([e]*d*) This transfer authority does not apply to supplemental appropriations, and is in addition to any other transfer authority provided in this or any other Act. The authority provided under this section shall expire on September 30, 2015.

([f]*e*) The Secretary shall notify the Committees on Appropriations of the House of Representatives and the Senate in writing not less than 30 days in advance of each transfer authorized by this section.

[SEC. 309. (a) Subject to subsection (b), no funds appropriated or otherwise made available by this Act or any other Act may be used to record transactions relating to the increase in borrowing authority or bonds outstanding at any time under the Federal Columbia River Transmission System Act (16 U.S.C. 838 et seq.) referred to in section 401 of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 140) under a funding account, subaccount, or fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol.

(b) Funds appropriated or otherwise made available by this Act or any other Act may be used to ensure, for purposes of meeting any applicable reporting provisions of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 115), that the Bonneville Power Administration uses a fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol solely to report accrued expenditures of projects attributed by the Administrator of the Bonneville Power Administration to the increased borrowing authority.

(c) This section is effective for fiscal year 2010 and subsequent fiscal years.]

[SEC. 310. Section 1702 of the Energy Policy Act of 2005 (42 U.S.C. 16512) is amended by adding at the end the following new subsection:

"(k) WAGE RATE REQUIREMENTS.—All laborers and mechanics employed by contractors and subcontractors in the performance of construction work financed in whole or in part by a loan guaranteed under this title shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards in this subsection, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code.".]

[SEC. 311. None of the funds made available by this Act may be used to make a grant allocation, discretionary grant award, discretionary contract award, Other Transaction Agreement, or to issue a letter of intent totaling in excess of $1,000,000, or to announce publicly the intention to make such an award, including a contract covered by the Federal Acquisition Regulation, unless the Secretary of Energy notifies the Committees on Appropriations of the Senate and the House of Representatives at least 3 full business days in advance of making such an award or issuing such a letter: *Provided*, That if the Secretary of the Department of Energy determines that compliance with this section would pose a substantial risk to human life, health, or safety, an award may be made without notification and the Committees on Appropriations of the Senate and the House of Representatives shall be notified not later than 5 full business days after such an award is made or letter issued.]

[SEC. 312. (a) ULTRA EFFICIENT VEHICLES.—Section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) is amended—
(1) in subsection (a)—
(A) in paragraph (1), by inserting "an ultra efficient vehicle or" after "means"; and
(B) by adding at the end the following new paragraph:
"(5) ULTRA EFFICIENT VEHICLE.—The term 'ultra efficient vehicle' means a fully closed compartment vehicle designed to carry at least 2 adult passengers that achieves—
"(A) at least 75 miles per gallon while operating on gasoline or diesel fuel;
"(B) at least 75 miles per gallon equivalent while operating as a hybrid electric-gasoline or electric-diesel vehicle; or
"(C) at least 75 miles per gallon equivalent while operating as a fully electric vehicle.";
(2) in subsection (b)—
(A) by inserting ", ultra efficient vehicle manufacturers," after "automobile manufacturers";
(B) in paragraph (1)—
(i) by striking "or" at the end of subparagraph (A);
(ii) by striking "and" at the end of subparagraph (B) and inserting "or"; and
(iii) by adding at the end the following new subparagraph:
"(C) ultra efficient vehicles; and"; and
(C) in paragraph (2), by inserting ", ultra efficient vehicles," after "qualifying vehicles";
(3) in subsection (g), by inserting "or are utilized primarily for the manufacture of ultra efficient vehicles" after "20 years"; and
(4) in subsection (h)(1)(B), by striking "automobiles" the first place it appears and inserting "ultra efficient vehicles, automobiles,".
(b) RECONSIDERATION OF PRIOR APPLICATIONS.—The Secretary of Energy shall reconsider applications for assistance under section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) that were—
(1) timely filed under that section before January 1, 2009;

(2) rejected on the basis that the vehicles to which the proposal related were not advanced technology vehicles; and

(3) related to ultra efficient vehicles.]

[SEC. 313. (a) Except as provided in subsection (b), none of the funds appropriated or otherwise made available by this title for the Strategic Petroleum Reserve may be made available to any person that as of the enactment of this Act—

(1) is selling refined petroleum products valued at $1,000,000 or more to the Islamic Republic of Iran;

(2) is engaged in an activity valued at $1,000,000 or more that could contribute to enhancing the ability of the Islamic Republic of Iran to import refined petroleum products, including—

(A) providing ships or shipping services to deliver refined petroleum products to the Islamic Republic of Iran;

(B) underwriting or otherwise providing insurance or reinsurance for such an activity; or

(C) financing or brokering such an activity; or

(3) is selling, leasing, or otherwise providing to the Islamic Republic of Iran any goods, services, or technology valued at $1,000,000 or more that could contribute to the maintenance or expansion of the capacity of the Islamic Republic of Iran to produce refined petroleum products.

(b) The prohibition on the use of funds under subsection (a) shall not apply with respect to any contract entered into by the United States Government before the date of the enactment of this Act.

(c) If the Secretary determines a person made ineligible by this section has ceased the activities enumerated in (a)(1)-(3), that person shall no longer be ineligible under this section.]

[SEC. 314. Section 132 of the Energy and Water Development Appropriations Act of 2006 (119 Stat 2261) is amended—

(1) in subsection (a)(3), by striking "Corps of Engineers" and inserting "Southwestern Power Administration";

(2) by adding at the end of subsection (a) the following new paragraph:

"(5) PAYMENT TO NON-FEDERAL LICENSEE.—Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 pursuant to paragraph (3) using receipts collected from the sale of Federal power and energy related services. Pursuant to paragraph (6), Southwestern Power Administration will begin collecting receipts in the Special Receipts and Disbursement account upon the date of enactment of this paragraph. Payment to the licensee of Federal Energy Regulatory Commission Project No. 2221 shall be paid as soon as adequate receipts are collected in the Special Receipts and Disbursement Account to fully compensate the licensee, and in accordance with paragraph (2), such payment shall be considered non-reimbursable.";

(3) by adding at the end of subsection (a) the following new paragraph:

"(6) The Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 in annual payments of not less than $5,000,000, until the licensee of Federal Energy Regulatory Commission Project No. 2221 is fully compensated pursuant to paragraph (3). At the end of each fiscal year subsequent to implementation, any remaining balance to be paid to the licensee of Project No. 2221 shall accrue interest at the 30-year U.S. Treasury bond rate in effect at the time of implementation of the White River Minimum Flows project.";

(4) by adding at the end of subsection (a) the following new paragraph:

"(7) ESTABLISHMENT OF SPECIAL RECEIPT AND DISBURSEMENT ACCOUNTS.—There is established in the Treasury of the United States a special receipt account and corresponding disbursement account to be made available to the Administrator of the Southwestern Power Administration to disburse pre-collected receipts from the sale of federal power and energy and related services. The accounts are authorized for the following uses:

"(A) Collect and disburse receipts for purchase power and wheeling expenses incurred by Southwestern Power Administration to purchase replacement power and energy as a result of implementation of the White River Minimum Flows project.

"(B) Collect and disburse receipts related to compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221.

"(C) Said special receipt and disbursement account shall remain available for not more than 12 months after the date of full compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221."; and

(5) by adding at the end of subsection (a) the following new paragraph:

"(8) TIME OF IMPLEMENTATION.—For purposes of paragraphs (3) and (4), `time of implementation' shall mean the authorization of the special receipt account and corresponding disbursement account described in paragraph (7).".]

SEC. 307. (a) Section 1801 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g) is amended in subsection (b)(2) by striking "amounts contained within the Fund" and inserting "assessments collected pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) as amended".

(b) Section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) is amended:

(1) in subsection (a):

(A) by striking *"$518,233,333" and inserting "$663,000,000"; and*

(B) by striking *"on October 24, 1992" and inserting "with fiscal year 2012".*

(2) in subsection (c):

(A) by inserting *"(1)" before "The Secretary";*

(B) by inserting *after "utilities": ", only to the extent provided in advance in appropriation Acts";*

(C) by striking "$150,000,000" and inserting "$200,000,000";

(D) by inserting *"beginning in fiscal year 2012" after "adjusted for inflation";*

(E) by striking "(1)" and inserting "(A)";

(F) by striking "(2)" and inserting "(B)";

(G) by adding a new paragraph 2, ",(2) Amounts authorized to be collected pursuant to this section shall be deposited in the Fund and credited as offsetting receipts."

(3) in subsection (d), by striking "for the period encompassing 15 years after the date of the enactment of this title" and inserting "through fiscal year 2026"; and

(4) in subsection (e):

(A) in paragraph (1), by striking "15 years after the date of the enactment of this title" and inserting "September 30, 2026";

(B) in *paragraph (2), by striking "$2,250,000,000" and inserting "$3,000,000,000"; and*

(C) in *paragraph (2) by inserting "beginning in fiscal year 2012" after "adjusted for inflation".*

SEC. 308. The Secretary shall collect up to $200,000,000 in assessments pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1), as amended by this Act.

SEC. 309. For an additional amount for the "Other Defense Activities" account, $11,891,755, to increase the Department's acquisition workforce capacity and capabilities: Provided, That such funds may be transferred by the Secretary to any other account in the Department to carry out the purposes provided herein: Provided further, That such transfer authority is in addition to any other transfer *authority provided in this Act: Provided further, That such funds shall be available only to supplement and not to supplant existing acquisition workforce activities: Provided further, That such funds shall be available for training, recruitment, retention, and hiring additional members of the acquisition workforce as defined by the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 401 et seq.): Provided further, That such funds shall be available for information technology in support of acquisition workforce effectiveness or for management solutions to improve acquisition management.*

SEC. 310. Not to exceed 5 per centum, or $100,000,000, of any appropriation, whichever is less, made available for Department of Energy activities funded in this Act or subsequent Energy and Water Development and Related Agencies Appropriation Acts may hereafter be transferred between such appropriations, but no appropriation, except as otherwise provided, shall be increased or decreased by more that 5 per centum by any such transfers, and any such proposed transfers shall be submitted to the Committee on Appropriations of the House and Senate. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. To the extent practicable funds made available in this Act should be used to purchase light bulbs that are "Energy Star" qualified or have the "Federal Energy Management Program" designation.

[SEC. 503. Title IV of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5) is amended by adding at the end of the title, the following new section 411:

"SEC 411. Up to 0.5 percent of each amount appropriated to the Department of the Army and the Bureau of Reclamation in this title may be used for the expenses of management and oversight of the programs, grants, and activities funded by such appropriation, and may be transferred by the Head of the Federal Agency involved to any other appropriate account within the department for that purpose: *Provided*, That the Secretary will provide a report to the Committees on Appropriations of the House of Representatives and the Senate 30 days prior to the transfer: *Provided further*,That funds set aside under this section shall remain available for obligation until September 30, 2012.".]

[SEC. 504. (a) DEFINITIONS.—In this section:

(1) *ADMINISTRATIVE* EXPENSES.—The term "administrative expenses" has the meaning as determined by the Director under subsection (b)(2).

(2) *AGENCY*.—The term "agency"—

(A) means an agency as defined under section 1101 of title 31, United States Code, that is established in the executive branch and receives funding under this Act; and

(B) shall not include the District of Columbia government.

(3) *DIRECTOR*.—The term "Director" means the Director of the Office of Management and Budget.

(b) ADMINISTRATIVE EXPENSES.—

(1) IN *GENERAL*.—All agencies shall include a separate category for administrative expenses when submitting their appropriation requests to the Office of Management and Budget for fiscal year 2011 and each fiscal year thereafter.

(2) *ADMINISTRATIVE* EXPENSES DETERMINED.—In consultation with the agencies, the Director shall establish and revise as necessary a definition of administration expenses for the purposes of this section. All questions regarding the definition of administrative expenses shall be resolved by the Director.

(c) BUDGET SUBMISSION.—Each budget of the United States Government submitted under section 1105 of title 31, United States Code, for fiscal year 2011 and each fiscal year thereafter shall include the amount requested for each agency for administrative expenses.]

[SEC. 505. None of the funds made available in this Act may be transferred to any department, agency, or instrumentality of the United States Government, except pursuant to a transfer made by, or transfer authority provided in this Act or any other appropriation Act.]

SEC. [506]*503.* [Specific projects contained in] *To the extent that* the report of the Committee on Appropriations of the House of Representatives accompanying this Act [(H. Rept. 111-203)] *includes specific projects* that are considered congressional earmarks for purposes of clause 9 of rule XXI of the Rules of the House of Representatives, *such projects,* when intended to be awarded to a for-profit entity, shall be awarded under a full and open competition. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

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Volume 5

Department of Energy
FY 2011 Congressional Budget Request

Environmental Management

February 2010 Office of Chief Financial Officer Volume 5

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Volume 5

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The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

For the latest details on the Department of Energy's implementation of the Recovery Act, please visit: http://www.energy.gov/recovery

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2009 Current Approp.	FY 2009 Current Recovery	FY 2010 Current Approp.	FY 2011 Congressional Request	FY 2011 vs. FY 2010	
					$	%
Discretionary Summary By Appropriation						
Energy And Water Development, And Related Agencies						
Appropriation Summary:						
Energy Programs						
Energy Efficiency and Renewable Energy	2,156,865	16,771,907	2,242,500	2,355,473	+112,973	+5.0%
Electricity Delivery and Energy Reliability	134,629	4,495,712	171,982	185,930	+13,948	+8.1%
Nuclear energy	791,444	0	786,637	824,052	+37,415	+4.8%
Fossil Energy Programs						
Clean Coal Technology	0	0	0	0	—	—
Fossil Energy Research and Development	863,104	3,398,607	672,383	586,583	-85,800	-12.8%
Naval Petroleum and Oil Shale Reserves	19,099	0	23,627	23,614	-13	-0.1%
Strategic Petroleum Reserve	226,586	0	243,823	138,861	-104,962	-43.0%
Strategic Petroleum Account	-21,586	0	0	0	—	—
Northeast Home Heating Oil Reserve	9,800	0	11,300	11,300	—	—
Total, Fossil Energy Programs	1,097,003	3,398,607	951,133	760,358	-190,775	-20.1%
Uranium Enrichment D&D Fund[1]	535,503	390,000	573,850	730,498	+156,648	+27.3%
Energy Information Administration	110,595	0	110,595	128,833	+18,238	+16.5%
Non-Defense Environmental Cleanup	261,819	483,000	254,673	225,163	-29,510	-11.6%
Science	4,813,470	1,632,918	4,903,710	5,121,437	+217,727	+4.4%
Energy Transformation Acceleration Fund	8,700	388,856	0	299,966	+299,966	N/A
Nuclear Waste Disposal	145,390	0	98,400	0	-98,400	-100.0%
Departmental Administration	155,326	42,000	168,944	169,132	+188	+0.1%
Inspector General	51,927	15,000	51,927	42,850	-9,077	-17.5%
Advanced Technology Vehicles Manufacturing Loan Program	7,510,000	10,000	20,000	9,998	-10,002	-50.0%
Innovative Technology Loan Guarantee Program	0	0	0	500,000	+500,000	N/A
Section 1705 Temporary Loan Guarantee Program	0	3,960,000	0	0	—	—
Total, Energy Programs	17,772,671	31,588,000	10,334,351	11,353,690	+1,019,339	+9.9%
Atomic Energy Defense Activities						
National Nuclear Security Administration:						
Weapons Activities	6,410,000	0	6,384,431	7,008,835	+624,404	+9.8%
Defense Nuclear Nonproliferation	1,545,071	0	2,136,709	2,687,167	+550,458	+25.8%
Naval Reactors	828,054	0	945,133	1,070,486	+125,353	+13.3%
Office of the Administrator	439,190	0	410,754	448,267	+37,513	+9.1%
Total, National Nuclear Security Administration	9,222,315	0	9,877,027	11,214,755	+1,337,728	+13.5%
Environmental and Other Defense Activities:						
Defense Environmental Cleanup[1]	5,656,345	5,127,000	5,642,331	5,588,039	-54,292	-1.0%
Other Defense Activities						
Health, Safety and Security	446,471	0	441,882	464,211	+22,329	+5.1%
Legacy Management	185,981	0	189,802	188,626	-1,176	-0.6%
Nuclear Energy	565,819	0	83,358	88,200	+4,842	+5.8%
Defense Related Administrative Support	108,190	0	122,982	130,728	+7,746	+6.3%
Office of Hearings and Appeals	6,603	0	6,444	6,444	—	—
Congressionally Directed Projects	999	0	3,000	0	-3,000	-100.0%
Total, Other Defense Activities	1,314,063	0	847,468	878,209	+30,741	+3.6%
Defense Nuclear Waste Disposal	143,000	0	98,400	0	-98,400	-100.0%
Total, Environmental & Other Defense Activities	7,113,408	5,127,000	6,588,199	6,466,248	-121,951	-1.9%
Total, Atomic Energy Defense Activities	16,335,723	5,127,000	16,465,226	17,681,003	+1,215,777	+7.4%
Power Marketing Administrations:						
Southeastern Power Administration	7,420	0	0	0	—	—
Southwestern Power Administration	28,414	0	13,076	12,699	-377	-2.9%
Western area Power Administration	218,346	10,000	109,181	105,558	-3,623	-3.3%
Falcon & Amistad Operating & Maintenance Fund	2,959	0	220	220	—	—
Colorado River Basins	-23,000	0	-23,000	-23,000	—	—
Total, Power Marketing Administrations	234,139	10,000	99,477	95,477	-4,000	-4.0%
Federal Energy Regulatory Commission	0	0	0	0	—	—
Subtotal, Energy And Water Development and Related Agencies	34,342,533	36,725,000	26,899,054	29,130,170	+2,231,116	+8.3%
Uranium Enrichment D&D Fund Discretionary Payments	-463,000	0	-463,000	-696,700	-233,700	-50.5%
Excess Fees and Recoveries, FERC	-23,080	0	-28,886	-29,111	-225	-0.8%
Cost of Implementing Reclassification of Receipts, PMAs	0	0	189,384	0	-189,384	-100.0%
Total, Discretionary Funding	33,856,453	36,725,000	26,596,552	28,404,359	+1,807,807	+6.8%

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[1] The Defense Environmental Cleanup/Uranium Enrichment Decontamination and Decommissioning Fund accounts reflect correctly the Administration's policy for the Department's FY 2011 request. These accounts include $47 million that was inadvertently omitted from the official Budget request. A budget amendment is expected to be forthcoming to formally correct for this error.

Environmental Management

Proposed Appropriation Language

Defense Environmental Cleanup
(Including Transfer of Funds)

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other expenses necessary for atomic energy defense environmental cleanup activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and the purchase of not to exceed [four] *two* ambulances and [three passenger motor vehicles] *one fire truck* for replacement only, [$5,642,331,000] *$5,588,039,000*, to remain available until expended, of which [$463,000,000] *$496,700,000* shall be transferred to the "Uranium Enrichment Decontamination and Decommissioning Fund"[: *Provided*, That, of the amount appropriated in this paragraph, $4,000,000 shall be used for projects specified in the table that appears under the heading "Congressionally Directed Defense Environmental Cleanup Projects" in the joint explanatory statement accompanying the conference report on this Act]. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Non-Defense Environmental Cleanup

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other expenses necessary for non-defense environmental cleanup activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, [$244,673,000] *$225,163,000*, to remain available until expended. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Uranium Enrichment Decontamination and Decommissioning Fund

For necessary expenses in carrying out uranium enrichment facility decontamination and decommissioning, remedial actions, and other activities of title II of the Atomic Energy Act of 1954, and title X, subtitle A, of the Energy Policy Act of 1992, [$573,850,000] *$730,498,000*, to be derived from the Uranium Enrichment Decontamination and Decommissioning Fund, to remain available until expended. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Explanation of Change

Changes are proposed to reflect the FY 2011 funding and vehicle request.

The Defense Environmental Cleanup/Uranium Enrichment Decontamination and Decommissioning accounts reflect correctly the Administration's policy for the Department's FY 2011 request. These accounts include $47 million that was inadvertently omitted from the official Budget request. A budget amendment is expected to be forthcoming to formally correct for this error.

Environmental Management
Overview
Appropriation Summary

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request[a]
Defense Environmental Cleanup	5,660,542	5,127,000	5,642,331	5,588,039
Non-Defense Environmental Cleanup	272,744	483,000	254,673	225,163
Uranium Enrichment Decontamination and Decommissioning Fund	535,503	390,000	573,850	730,498
Subtotal, Environmental Management	6,468,789	6,000,000	6,470,854	6,543,700
Use of Prior Year (Defense Environmental Cleanup)	-4,197	0	0	0
Use of Prior year (Non-Defense Environmental Cleanup)	-925	0	0	0
Transfer from Office of Science	-10,000	0	0	0
D&D Fund Offset	-463,000	0	-463,000	-496,700
Total, Environmental Management	5,990,667	6,000,000	6,007,854	6,047,000

[a] The Defense Environmental Cleanup/Uranium Enrichment Decontamination and Decommissioning accounts reflect correctly the Administration's policy for the Department's FY 2011 request. These accounts include $47 million that was inadvertently omitted from the official Budget request. A budget amendment is expected to be forthcoming to formally correct for this error.

Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Defense Environmental Cleanup				
Closure Sites				
Closure Sites Administration	13,209	0	8,225	6,375
Fernald	2,100	0	0	0
Miamisburg	30,574	19,700	33,243	0
Total, Closure Sites	45,883	19,700	41,468	6,375
Hanford Site				
2012 Accelerated Completions	476,491	520,080	541,367	0
2035 Accelerated Completions	490,485	1,114,420	448,713	0
Central Plateau Remediation	0	0	0	423,640
River Corridor and Other Cleanup Operations	0	0	0	545,289
Total, Hanford Site	966,976	1,634,500	990,080	968,929
Idaho National Laboratory	475,761	467,875	464,168	407,100
NNSA Sites				
California Site Support	0	0	238	238
Lawrence Livermore National Laboratory	688	0	910	635
Los Alamos National Laboratory	222,734	197,000	196,500	196,953
Nevada	75,674	44,325	65,674	66,000

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
NNSA Service Center/Separations Processing Research Unit (SPRU)	19,443	51,775	17,938	15,547
Pantex	1,000	0	0	0
Sandia National Laboratories	3,000	0	2,864	0
Total, NNSA Sites	322,539	293,100	284,124	279,373
Oak Ridge	262,835	558,110	178,768	202,298
Office of River Protection				
Tank Farm Activities	319,943	326,035	408,000	418,000
Waste Treatment and Immobilization Plant	690,000	0	690,000	740,178
Total, Office of River Protection	1,009,943	326,035	1,098,000	1,158,178
Savannah River Site				
2035 Accelerations	129,626	1,415,400	57,068	0
Cleanup and Waste Disposition	0	0	0	18,330
Nuclear Material Stabilization and Disposition	361,343	0	391,625	0
Site Risk Management Operations	0	0	0	1,199,469
Tank Farm Activities	731,774	200,000	761,256	0
Total, Savannah River Site	1,222,743	1,615,400	1,209,949	1,217,799
Waste Isolation Pilot Plant	231,661	172,375	230,337	220,245
Program Support	33,930	0	34,000	25,143
Program Direction	309,807	25,635	345,000	323,825
Safeguards and Security	266,141	0	279,437	249,754
Technology Development and Deployment	31,415	0	20,000	32,320
Federal Contribution to the Uranium Enrichment D&D Fund	463,000	0	463,000	496,700
Congressionally Directed Projects	17,908	0	4,000	0
ARRA Defense Unallocated	0	14,270	0	0
Total, Defense Environmental Cleanup	5,660,542	5,127,000	5,642,331	5,588,039
Non-Defense Environmental Cleanup				
Program Direction	0	2,415	0	0
Fast Flux Test Reactor Facility D&D	10,755	0	7,652	3,659
Congressionally Directed Projects	4,757	0	0	0
Gaseous Diffusion Plants				
Paducah Gaseous Diffusion Plant	45,305	0	47,491	52,490
Portsmouth Gaseous Diffusion Plant	35,991	0	53,394	46,974
Total, Gaseous Diffusion Plants	81,296	0	100,885	99,464
ARRA Non-Defense Unallocated	0	1,830	0	0
Small Sites				
Argonne National Laboratory	19,479	98,500	10,000	0
Brookhaven National Laboratory	8,433	42,355	15,000	13,861
California Site Support	187	0	262	0
Completed Sites/Program Support	1,100	0	1,200	0
Energy Technology Engineering Center	15,000	54,175	10,500	10,679
Idaho National Laboratory	13,478	0	5,000	4,900
Inhalation Toxicology Laboratory	272	0	0	0
Los Alamos National Laboratory	1,905	14,775	0	0
Moab	40,699	108,350	39,000	31,000
Oak Ridge	0	78,800	0	0
SLAC National Accelerator Laboratory	4,883	7,925	7,100	3,526
Tuba City	5,000	0	0	0
Total, Small Sites	110,436	404,880	88,062	63,966
West Valley Demonstration Project	65,500	73,875	58,074	58,074

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Total, Non-Defense Environmental Cleanup	272,744	483,000	254,673	225,163
Uranium Enrichment Decontamination and Decommissioning Fund				
Program Direction	0	1,950	0	0
D&D Activities				
Oak Ridge	208,833	118,200	225,000	230,402
Paducah Gaseous Diffusion Plant	116,446	78,800	116,446	84,014
Portsmouth Gaseous Diffusion Plant	200,224	118,200	232,404	416,082
Total, D&D Activities	525,503	315,200	573,850	730,498
ARRA UE D&D Unallocated	0	3,900	0	0
U/Th Reimbursements	10,000	68,950	0	0
Total, Uranium Enrichment Decontamination and Decommissioning Fund	535,503	390,000	573,850	730,498
Total, Environmental Management	6,468,789	6,000,000	6,470,854	6,543,700
Use of Prior Year (Defense Environmental Cleanup)	-4,197	0	0	0
Use of Prior year (Non-Defense Environmental Cleanup)	-925	0	0	0
Transfer from Office of Science	-10,000	0	0	0
D&D Fund Offset	-463,000	0	-463,000	-496,700
Total, Environmental Management	5,990,667	6,000,000	6,007,854	6,047,000

Funding by Budget Chapters

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Carlsbad	231,661	230,337	220,245
Idaho	489,239	469,168	412,000
Oak Ridge			
Oak Ridge	471,668	403,768	432,700
Paducah	161,751	163,937	136,504
Portsmouth	236,215	285,798	463,056
Richland	977,731	997,732	972,588
River Protection	1,009,943	1,098,000	1,158,178
Savannah River	1,222,743	1,209,949	1,217,799
NNSA Sites			
California Site Support	0	238	238
Nevada	75,674	65,674	66,000
NNSA Service Center/Separations Processing Research Unit (SPRU)	19,443	17,938	15,547
Lawrence Livermore National Laboratory	688	910	635
Los Alamos National Laboratory	224,639	196,500	196,953
Pantex	1,000	0	0
Sandia National Laboratories	3,000	2,864	0
Subtotal, NNSA Sites	324,444	284,124	279,373

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Closure Sites			
Closure Sites Administration	13,209	8,225	6,375
Fernald	2,100	0	0
Miamisburg	30,574	33,243	0
Subtotal, Closure Sites	45,883	41,468	6,375
All Other Sites			
Completed Sites/Program Support	1,100	1,200	0
Brookhaven National Laboratory	8,433	15,000	13,861
California Site Support	187	262	0
Argonne National Laboratory	19,479	10,000	0
Energy Technology Engineering Center	15,000	10,500	10,679
Inhalation Toxicology Laboratory	272	0	0
Moab	40,699	39,000	31,000
Tuba City	5,000	0	0
SLAC National Accelerator Laboratory	4,883	7,100	3,526
Subtotal, All Other Sites	95,053	83,062	59,066
Safeguards and Security	266,141	279,437	249,754
Headquarters Operations	66,595	38,000	25,143
West Valley Demonstration Project	65,500	58,074	58,074
Technology Development & Deployment	31,415	20,000	32,320
Program Direction	309,807	345,000	323,825
D&D Fund Deposit	463,000	463,000	496,700
Subtotal, Environmental Management	6,468,789	6,470,854	6,543,700
Use of Prior Year (Defense Environmental Cleanup)	-4,197	0	0
Use of Prior year (Non-Defense Environmental Cleanup)	-925	0	0
Transfer from Office of Science	-10,000	0	0
D&D Fund Offset	-463,000	-463,000	-496,700
Total, Environmental Management	5,990,667	6,007,854	6,047,000

Mission

Fifty years of nuclear weapons production and energy research generated millions of gallons of liquid radioactive waste, millions of cubic meters of solid radioactive wastes, thousands of tons of spent nuclear fuel and special nuclear material, along with huge quantities of contaminated soil and water. The Environmental Management program was established in 1989 to achieve the successful cleanup of this Cold War legacy. The mission of the Office of Environmental Management (EM) is to complete the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development, production, and Government-sponsored nuclear energy research. This cleanup effort is the largest in the world, originally involving two million acres at 107 sites in 35 states and some of the most dangerous materials known to man.

In that it took five decades to create the Cold War environmental legacy, it is EM's goal to complete the cleanup in approximately six decades within the currently estimated life-cycle cost of $275 to $329 billion. This includes $82 billion in actual costs from 1997 through 2009, and an additional estimate of $193 to $247 billion to complete EM's remaining mission.

EM's overall goal is to complete the cleanup of the legacy of the Cold War in a safe, secure, and compliant manner, on schedule and within budget. EM will continue to pursue its cleanup objectives in a manner that maximizes risk reduction and overlays its regulatory compliance commitments and best business practices to maximize cleanup progress.

In order to execute the mission, EM has ranked, in priority order, those activities with the greatest risk, while adhering to all safety orders as our upmost priority. EM is committed to its safety principles and will continue to maintain and demand the highest safety performance to protect the workers and the communities where EM operates.

Performance

The EM program directly supports the Department's goals of Innovation – to lead the world in science, technology, and engineering; and Security – to reduce nuclear dangers and environmental risks. Examples of these goals in the FY 2011 budget request include the following activities.

Tank waste is EM's most significant environmental, safety, and health threat. It is also the largest cost element of the cleanup program with a life-cycle range estimated between $87 billion and $117 billion, which represents between 32 percent and 35 percent of the program's total cost. The Office of River Protection's share of the tank waste lifecycle cost is between $57 billion and $75 billion. This budget request contains $60 million specifically at the Office of River Protection for science and technology investments in tank waste technologies. This investment is intended to significantly reduce both the technical uncertainty and the life-cycle cost associated with building and operating these one of kind tank waste processing facilities. In addition, it will also further EM's ability to reduce the most significant environmental risk in the complex.

EM will also continue to implement its footprint reduction strategy with a combination of both base program and Recovery Act funds. At large sites, EM will focus on area closures and cleanup activities such as D&D, soil and groundwater remediation and solid waste disposition. EM's success in these areas will reduce lifecycle program costs. These activities have an established regulatory framework and proven technologies; ultimately, completion of these types of cleanup activities reduces the surveillance and maintenance costs associate with managing large tracks of land.

EM will also continue to conduct independent reviews, modeled after the Office of Science's Lehman Reviews. These reviews examine in detail all aspects of a construction project, including project management, technology, design, engineering, safety, environment, security, and quality assurance. The process relies on expert knowledge and experience of world-class engineers, scientists, and managers sourced from federal staff, DOE contractors, engineering firms, national laboratories, and the academic community. These reviews will assess the progress of each of its major projects and determine their overall health and ability to meet cost and schedule goals. Scheduled approximately every 6-9 months, these reviews are intended to reduce the risk of project failure by identifying existing and potential concerns in a timely manner so that the Waste Treatment and Immobilization Plant and processing facilities are brought on to support overall environmental risk reduction.

Overview

EM continues to pursue its cleanup objectives within the overall framework of achieving the greatest risk reduction benefit per radioactive content and overlaying regulatory compliance commitments and best business practices to maximize cleanup progress. To support this approach, EM has prioritized its cleanup activities:

- Activities to maintain a safe and secure posture in the EM complex
- Radioactive tank waste stabilization, treatment, and disposal
- Spent nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, processing, and disposition
- High risk soil and groundwater remediation
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning

In addition to these priorities, other equally important strategies are integrated into cleanup activities important not only to the achievement of EM cleanup progress, but also important to our stakeholders and states where cleanup sites are located. Most importantly, EM will continue to discharge its responsibilities by conducting cleanup within a "Safety First" culture that integrates environment, safety, and health requirements and controls into all work activities to ensure protection to the workers, public, and the environment, and adheres to the project and contract management principles as defined in DOE Order 413.3A. As part of this, project risks are defined and risk integration strategies are developed.

The performance of the EM program is measured against the scope, schedule, and cost of each project in the program. Sixteen corporate performance metrics are also used to assess and communicate the annual and life-cycle progress of the EM cleanup program. Each metric is tracked against the projected life-cycle quantities necessary to complete cleanup at each site. Together, the scope, cost, schedule and the performance metrics, which are under configuration control, clearly establish agreed-upon performance expectations.

Project cost, schedule, and performance, including earned value data, continue to be reviewed on a regular basis. In FY 2011 EM will continue to focus on project management. Two new initiatives are being implemented to further improve project management. Spurred on by the implementation of the American Reinvestment and Recovery Act (Recovery Act), EM has undertaken a broad restructuring of the EM portfolio of projects, programs, and activities that align work scope into operating and capital asset activities. In addition, EM intends to implement a corporate work breakdown structure (WBS) that will define and group a project's discrete work elements or tasks in a way that helps organize and define the total work scope of the project. A corporate WBS will provide EM with a consistent framework for cost estimating and schedule control.

EM intends to accomplish its primary goal of achieving the greatest risk reduction benefit per radioactive content by focusing on these primary areas:

- Life-cycle Cost Management (LCC)—EM's objective is complete cleanup of the Cold War environmental legacy in approximately six decades within the currently estimated LCC. EM will achieve this through proactive management of its LCC estimate. In addition, EM intends to utilize science and technology to reduce the cost associated with tank waste and special nuclear material processing.

- Footprint Reduction—Footprint reduction and small site completions accelerate environmental clean-up in 14 states and reduce life-cycle costs by eliminating years of infrastructure maintenance. EM's objective is to reduce the legacy footprint 40% by the end of FY 2011 and 80% to 90% by the end of FY 2015.

FY 2011 Budget

The FY 2011 investment of $6.0 billion in budget authority will be utilized to fund activities to maintain a safe, secure and compliant posture in the EM complex. Specifically, the budget funds the construction and operation of three unique and complex tank waste processing plants to treat approximately 88 million gallons of radioactive tank waste for ultimate disposal. With a total cost estimate of $14.3 billion for these processing plants – one of the primary risk and cost drivers in the program – investments are still needed to complete construction and begin the operation of these necessary facilities to process the tank waste. The request will also fund the solid waste disposal infrastructure needed to support disposal of transuranic and low-level wastes generated by high-risk activities and the footprint reduction activities.

Receipt of Recovery Act funding has allowed EM to fund the majority of its high risk activities within its base budget request of $6.0 billion. However, to meet out-year milestones, specific activities such as build out of tank farm infrastructure needed to support waste feed to both the Salt Waste Processing Facility at Savannah River Site (SRS), and the Waste Treatment and Immobilization Plant at Hanford are being funded with Recovery Act funds.

In FY 2011, the appropriation request will support the Administration's commitment to accelerate cleanup of the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio by increasing the site's base funding to a total of $479 million. Approximately $47 million of that total will be used to commence safe operation of the DUF6 Project conversion facilities and disposition the resultant uranium oxide and hydrofluoric acid. About 9,800 metric tons of depleted uranium will be packaged for disposition. Most of the funding request will be used for increased level of decontamination and decommissioning of gaseous diffusion plant ancillary facilities and systems, for disposing of decontamination and decommissioning waste off-site, and to begin small equipment removal, utility optimizations and hazardous material abatement actions within the gaseous diffusion plant operations buildings.

At Idaho, the FY 2011 request will enable completion of the sodium-bearing waste treatment facility testing and readiness verification in preparation for hot startup in June, 2011. This project will treat approximately 900,000 gallons of sodium bearing waste stored in waste tanks that are 35 to 45 years old. The treatment of this waste will enable EM to meet the Notice of Noncompliance – Consent Order Modification to cease use of the Tank Farm Facility by December 31, 2012. Additionally, the request will meet requirements of the Idaho Settlement Agreement by disposing remote-handled low-level waste at the Radioactive Waste Management Complex; mixed low-level waste at appropriate off-site disposal facilities; and characterizing and certifying remote-handled transuranic waste at the Idaho Nuclear Technology and Engineering Center in preparation for shipment to the Waste Isolation Pilot Plant. The request will provide for shipping stored contact-handled transuranic waste to the Waste Isolation Pilot Plant using the Advanced Mixed Waste Treatment Facility, and for receipt, characterization, and certification of transuranic waste from other DOE sites in preparation for shipment to the Waste Isolation Pilot Plant.

At Richland, significant progress will continue to be made along the River Corridor. EM will complete excavation of 3 of the 5 burial grounds in the 100-H Area, complete 22 interim remedial actions at the 100 B/C Area, complete disposition of eight facilities, and initiate interim safe storage of the 105-KE Reactor and D4 100K Area facilities. These efforts are aimed at reducing the Richland site footprint by up to 40% in 2011.

The Oak Ridge National Laboratory maintains the Department's inventory of Uranium-233 (U-233), which is currently stored in Building 3019. The FY 2011 funding request will continue design of a project that processes the U-233 material in preparation for future disposal. Benefits include reducing safeguards and security requirements and eliminating long-term worker safety and criticality concerns. Recent discoveries of structural integrity issues with Building 3019 and determination that a portion of the U-233 is unsuitable for disposal at WIPP will require significant design changes to the facility. EM plans to continue the design effort through 90 percent design in FY 2011. At that point, a new baseline for construction and operations will be established. This will ensure that the construction estimate will have the accuracy necessary to complete the project on schedule and within budget.

At the Savannah River Site, the H Area facilities will continue to stabilize and disposition enriched uranium materials through the middle of FY 2011. Funding is included for H Area infrastructure upgrades. The site will also continue to receive weapons grade surplus non-pit plutonium from the Los Alamos National Laboratory, and Lawrence Livermore National Laboratory. The largest portion of the request will be for continued operation of interim salt processing facilities, operation of the Defense Waste Processing Facility to complete 297 canisters of glass waste, and continued construction of the Salt Waste Processing Facility. Finally, the Savannah River request will provide for returning Tank 48 to service and performing Bulk Waste Removal operations in order to support the Defense Waste Processing Facility feed preparation, Actinide Removal Process and Modular Caustic Side Extraction feed preparation, as well as support of tank closure activities. The combination of funding from the Recovery Act and the FY 2011 request will reduce the site's industrial area by 40 percent by September 2011.

EM will achieve four facility completions in FY 2011. Legacy cleanup completion will be achieved in FY 2011 at the General Electric Vallecitos Nuclear Center, Brookhaven National Laboratory, the Separations Process Research Unit, and the Stanford Linear Accelerator Center. The last three completions are being accelerated through the combination of Recovery Act and annual appropriations.

To address many of the high-risk activities facing the EM program, a total of $32 million is requested for Technology Development and Demonstration (TD&D) efforts. The FY 2011 Request will increase acceleration of technology development for addressing tank waste issues related to waste chemistry for characterization and separation; advanced retrieval technologies; improved melter throughput; and increased glass waste loading. Additionally, subsurface science issues to support development of state-of the-art methods and models for fate and transport in the subsurface. This reduces the uncertainty in the current models and methods for performance assessments. Finally, design and adaptation of cost-effective remediation tools for deactivation and decommissioning will be performed.

The Yucca Mountain Project to construct a geologic repository for high-level waste in a remote corner of the Nevada Test Site will be terminated in FY 2010. During FY 2010, the Office of Civilian Radioactive Waste Management will prepare the repository site for stewardship and remediation. The Department will work with state and federal agencies to develop a remediation plan that adheres to all applicable statutes and regulations for the site. EM staff will support remediation planning for the Yucca Mountain repository site.

American Reinvestment and Recovery Act

In addition to the base budget request of $6.0 billion, EM will continue to expend the $6 billion in Recovery Act funding provided by Congress to complete lower-risk footprint reduction and near-term completion cleanup activities. Table 1 below highlights the Recovery Act funding by site. Recovery Act work is accelerating the completion of existing environmental protection and site cleanup goals, including decontamination and decommissioning (D&D) of excess nuclear facilities and disposal of radioactive waste from the EM sites, in many cases much earlier than originally planned. In addition, this work reduces environmental threats to areas surrounding the sites resulting in job creation, cost savings over the life-cycle of the EM program, and enhanced environmental protection

Recovery Act funding is being utilized by EM site contractors and subcontractors who are hiring workers to perform the additional soil and groundwater remediation, decontamination and decommissioning, and waste processing activities. Workers that will be utilized include well drillers, soil excavation personnel, construction and demolition personnel, waste processors and handlers, railroad train crews and waste truck drivers.

As of December 2009, EM obligated over $5.8 billion in Recovery Act funding and created and/or saved over 4,000 jobs. Recovery Act funded projects are described in more detail in each site overview section contained in the detailed budget justification.

The tables below show the site distribution (Table 1) and metrics (Table 2) associated with Recovery Act funding.

Table 1. Recovery Act Funding by Site

Site	Defense	Non-Defense	UE D&D	TOTAL
Argonne National Laboratory		98,500,000		98,500,000
Brookhaven National Laboratory		42,355,000		42,355,000
Carlsbad Field Office	172,375,000			172,375,000
Energy Technology Engineering Center		54,175,000		54,175,000
Idaho National Laboratory	467,875,000			467,875,000
Los Alamos National Laboratory	197,000,000	14,775,000		211,775,000
Moab		108,350,000		108,350,000
Mound	19,700,000			19,700,000
Nevada Test Site	44,325,000			44,325,000
Oak Ridge Reservation	558,110,000	78,800,000	118,200,000	755,110,000
Office of River Protection	326,035,000			326,035,000
Paducah			78,800,000	78,800,000
Portsmouth			118,200,000	118,200,000
Richland	1,634,500,000			1,634,500,000
Savannah River	1,615,400,000			1,615,400,000
Separations Processing Research Unit	51,775,000			51,775,000
Title X Uranium/Thorium Reimbursement Program			68,950,000	68,950,000
West Valley		73,875,000		73,875,000
SLAC National Accelerator Laboratory		7,925,000		7,925,000
Program Direction/Other	39,905,000	4,245,000	5,850,000	50,000,000
TOTALS	**5,127,000,000**	**483,000,000**	**390,000,000**	**6,000,000,000**

With Recovery Act funding, EM has been able to accelerate many activities planned for the outyears. The EM program has identified those performance metrics that reflect activities that are being accomplished through the use of Recovery Act funding. The table (shown below) identifies the portion of the EM Corporate Performance Metrics that are associated with Recovery Act projects and is provided here for the reader's information. The performance metrics listed for Recovery Act projects are separate and above those planned to be accomplished provided in the FY 2011 Budget Request. Unless specifically identified with Recovery Act funding, all the metrics tables displayed in this document reflect the annual appropriations for FY 2009, FY 2010 and the request for FY 2011.

Table 2. Recovery Act Performance Metrics

Corporate Performance Measures – EM Totals (ARRA Only)[a]

	Complete Through FY 2009	Cumulative FY 2010 Target	Cumulative FY 2011 Target
Geographic Sites Eliminated (number of sites)	0	0	3
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	0	0	0
Enriched Uranium packaged for disposition (Number of Containers)	0	0	0
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	0	0	0
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	11,646	11,646
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0
Liquid Waste Tanks closed (Number of Tanks)	0	0	0
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	0	0	0
Transuranic Waste shipped for disposal (Cubic meters) - CH	180	3,147	8,031
Transuranic Waste shipped for disposal (Cubic meters) - RH	17	113	487
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	4,468	24,096	72,080
Material Access Areas eliminated (Number of Material Access Areas)	0	0	0
Nuclear Facility Completions (Number of Facilities)	8	19	37
Radioactive Facility Completions (Number of Facilities)	6	43	87
Industrial Facility Completions (Number of Facilities)	12	55	98
Remediation Complete (Number of Release Sites)	3	33	93

Highlights of the Request

For FY 2011, EM's funding priorities are as follows:

- Requisite safety, security, and services across EM cleanup sites;
- Post-closure contract liabilities;
- Radioactive tank waste stabilization, treatment, and disposal;
- Spent nuclear fuel storage, receipt, and disposition;
- Special nuclear materials consolidation, processing, and disposition;
- High risk soil and groundwater remediation;
- Solid waste (transuranic, low-level, and mixed low-level wastes) treatment, storage, and disposal;

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[a] Performance measures are currently being updated.

- Soil and groundwater remediation; and
- Decontamination and decommissioning of excess contaminated facilities.

Based on these priorities, EM's FY 2011 request of $6.0 billion will fund the following activities:

- Safe and secure operations;
- Hanford Waste Treatment and Immobilization Plant ($740M), completion of two C-Farm Single-Shell Tank retrievals ($60M);
- Tank farm operations at the Hanford, Idaho, and Savannah River sites ($994M);
- Idaho Sodium Bearing Waste Treatment construction activities ($6.5M);
- Savannah River Salt Waste Processing Facility construction and pre-operations ($288M);
- Special nuclear material consolidation/disposition and storage ($485M), this includes H canyon operations ($370M), and U-233/Building 3019 processing ($50M);
- DUF6 Operations at Portsmouth and Paducah ($99.5M);
- Solid Waste (TRU and Mixed/Low level waste) storage, treatment, and disposal ($673M) includes operations of WIPP to support contact-handled and remote-handled shipments and operations of the Nevada Test Site to dispose of low-level and mixed low-level wastes;
- Soil and ground water remediation at Idaho, Hanford, Nevada, Los Alamos and Small site ($415M);
- Acceleration of Portsmouth D&D ($374M);
- Decontamination and decommissioning work to maintain site progress ($1,007M);
- Investment in tank waste technologies within the Office of River Protection ($50M); and
- Community and Regulatory activities ($57M).

FY 2010 Accomplishments and FY 2011 Highlights

EM continues to make significant cleanup progress demonstrated by:

- Continue consolidation of all nuclear materials at the Savannah River Site.
- Processed for disposition over two and a half million gallons of radioactive liquid waste at the Savannah River Site.
- Producing over 3,500 cans of vitrified high-level waste from highly radioactive liquid wastes (Savannah River Site and the West Valley Demonstration Project) by the end of FY 2011.
- By the end of FY 2011, characterize and certify approximately 80,000 cubic meters of transuranic waste from many sites to the Waste Isolation Pilot Plant and ship that waste from many sites over 8,000,000 miles for permanent disposal, without any major incident and with no release.
- Disposing of over one million cubic meters of legacy low-level waste and mixed low-level waste.
- Safely closing eleven of the fifteen radioactive liquid waste tanks at the Idaho National Laboratory.
- Over eight million gallons of high-level waste has been calcined (dried into powder) into about 4,400 cubic meters of calcine. This reduced the volume of liquid waste remaining in the tank farm to approximately one million gallons of sodium-bearing waste at the Idaho Site.
- All assigned legacy special nuclear material has been disposed and all EM assigned spent nuclear fuel will be in dry storage at the Idaho Site.
- Complete construction and readiness testing in preparation for hot start up of the Sodium Bearing Waste facility at the Idaho Site.
- Dispose of all legacy suspect transuranic waste from the Separations Process Research Unit (SPRU) by the end of FY 2011.

- Complete shipment of legacy contact-handled transuranic waste in FY 2010 and FY 2011 from small sites by consolidating at Idaho National Laboratory for CCP certification, with final disposal at WIPP.
- EM completes 90% of the design for the Downblend of U-233 in Building 3019.
- Savannah River returns Tank 48 to service and performs Bulk Waste Removal operations in order to support feed preparation and support tank closure activities.

Strategic Themes and Goals and GPRA Program Goals

The following chart aligns the current Strategic Plan with the Secretary's priorities:

Strategic Theme	Strategic Goal Title	Secretary's Priorities	GPRA Unit Program Number	GPRA Unit Program Title	Office
4. Environmental Responsibility	1. Environmental Cleanup	National Security and Legacy	53	Environmental Management	EM

Annual Performance Results and Targets

EM has developed 16 corporate performance measures to enable the program to monitor annual and life-cycle progress towards meeting the Department's Strategic Goal 4 and EM's Program Goal. These corporate performance measures are:

- Certified DOE storage/treatment/disposal 3013 containers (or equivalent) of plutonium metal or oxide packaged ready for long-term storage;
- Certified containers of enriched uranium packaged ready for long-term storage;
- Plutonium or uranium residues packaged for disposition (kg of bulk material);
- Depleted and other uranium packaged for disposition (metric tons).
- Liquid waste eliminated (millions of gallons);
- Number of liquid tanks closed;
- Canisters of high-level waste packaged for final disposition;
- Spent nuclear fuel packaged for final disposition (metric tons of heavy metal);
- Transuranic waste dispositioned (cubic meters);
- Low-level waste/mixed low-level waste disposed (cubic meters);
- Number of material access areas eliminated;
- Number of nuclear facilities completed;
- Number of radioactive facilities completed;
- Number of industrial facilities completed;
- Number of release sites remediated; and

- Number of geographic sites closed.

Each of these 16 corporate performance measures is quantitative and focuses on the accomplishment of risk-reducing actions and life-cycle reduction. Each measure is tracked in the context of the total measure (life-cycle) necessary to complete each site as well as the EM program as a whole. The corporate measures are under configuration control, thereby establishing performance expectations and accountability for those expectations within a given funding level. Through configuration control, EM is able to make corporate decisions that will keep the program on track, monitor and control costs and schedules, and manage site closure expectations. In addition to the corporate measures, performance is also tracked through the implementation of earned value management, which are used to demonstrate whether a project and site are on track to achieve agreed upon performance expectations.

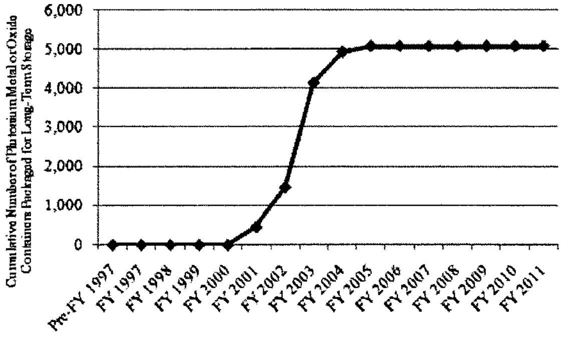
Nuclear Materials

Reducing the inventory of high-risk nuclear materials by preparing it for long-term storage or disposition quantitatively measures EM's progress towards environmental, safety, and security risk reduction. The stabilization and packaging of nuclear materials indicates a reduction in an activity that is a major cost driver for the EM program. The following four corporate performance measures (and the identification of the sites that mainly contribute to each of the measures for which work scope remains) are depicted below.

- Plutonium metal or oxide containers packaged for long-term storage (all work for this corporate performance measure has been completed)
- Enriched uranium containers packaged for long-term storage (Hanford Site, Savannah River Site, and Idaho National Laboratory)
- Plutonium or uranium residues packaged for disposition (all work for this corporate performance measure has been completed) and
- Depleted and other uranium packaged for disposition (Hanford, Savannah River Site, Paducah, and Portsmouth)

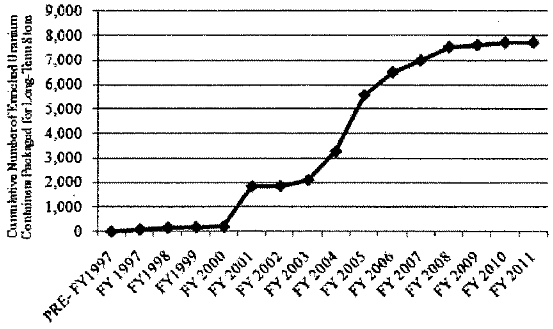
Plutonium Metal or Oxide Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
5,089	Measure Completed			100%	5,089



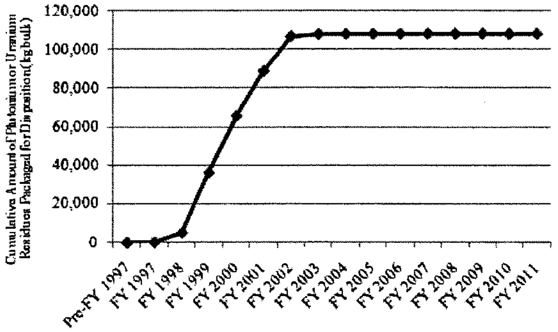
Enriched Uranium Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
7,548	7,629	7,728	7,728	98%	7,910



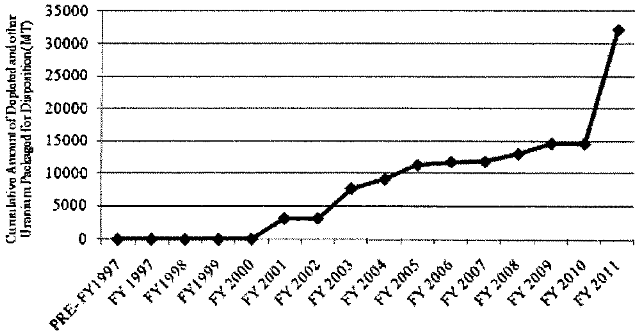
Plutonium or Uranium Residues Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
107,828	Measure Completed			100%	107,828



Depleted and Other Uranium Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
13,074	14,636	14,636	32,186	4%	736,832



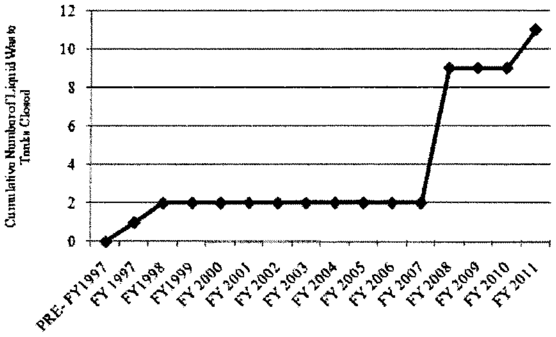
Liquid Waste

By reducing the amount of high risk radioactive liquid waste in the inventory and subsequent closing of the liquid waste tanks, EM is demonstrating tangible evidence of the program's goal to reduce the highest risks in the complex first. In addition to eliminating high-risk material, corresponding life-cycle cost reductions are achieved for an activity that is a major cost driver to the EM program. The following two corporate measures (and the identification of the sites that mainly contribute to each of the measures) are depicted below:

- Liquid waste in inventory eliminated (West Valley, Hanford Site and Savannah River Site) and
- Liquid waste tanks closed (Hanford Site, Savannah River Site, and Idaho National Laboratory)

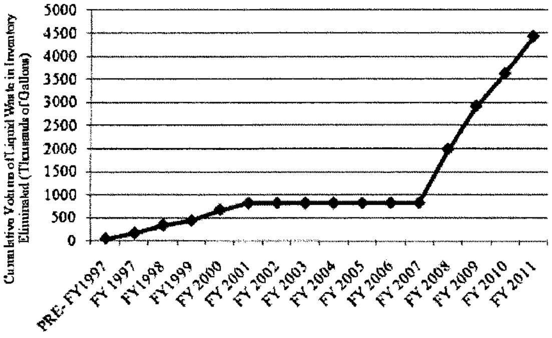
Liquid Waste Tank Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
9	9	9	11	4%	239



Liquid Waste in Inventory Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
1,988	2,924	3,624	4,424	5%	88,814

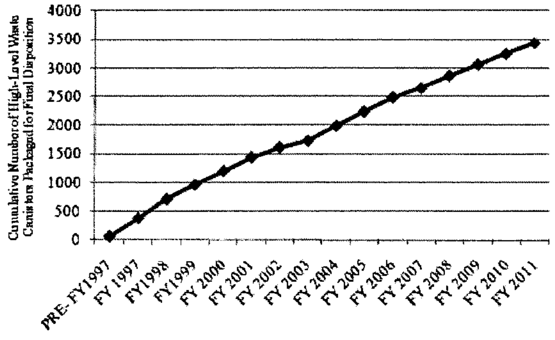


High-Level Waste and Spent Nuclear Fuel

The EM program is preparing high-level waste and spent nuclear fuel for final disposition in order to ensure the material is ready for offsite disposal. Completion of high-level waste and spent nuclear fuel activities indicates the reduction of both high risk and cost incurring activities. The Hanford Site, Savannah River Site, and Idaho National Laboratory primarily contribute to both the high-level waste measure and the spent nuclear fuel measure. Both corporate performance measures are depicted below.

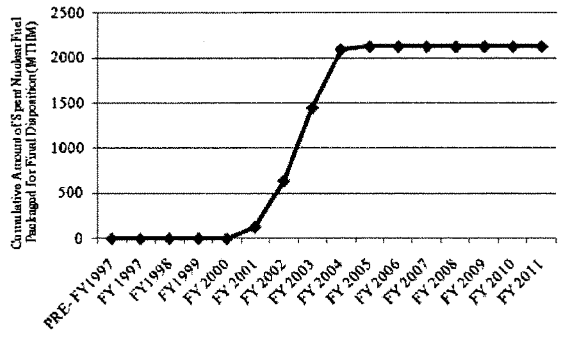
High-Level Waste Canister Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
2,874	3,070	3,256	3,553	16%	22,902



Spent Nuclear Fuel Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
2,128	2,128	2,128	2,128	88%	2,418



Transuranic Waste and Legacy and Newly Generated Low-Level/Mixed Low-Level Waste

The disposition of transuranic waste metric measures a site's progress toward accelerating cleanup and reducing risk. This measure reflects the progress the generator site has made to manage and prepare its inventory of transuranic (and suspect-transuranic) waste for disposal; it also reflects support from the Department's disposal facilities, in many cases. In FY 2011, the Idaho National Laboratory, Los Alamos National Laboratory, and Oak Ridge are the primary contributors to the transuranic waste corporate measure using funds within this budget request.[a] The volume included within the FY 2011 target reflects that the transuranic disposition activities at several sites (e.g., Argonne National Lab, Savannah River Site) are supported in part or in total by funds provided by the American Recovery and Reinvestment Act. This metric also provides information on the disposition of both remote-handled transuranic and contact-handled transuranic waste. It is important to note that the budget request supports the operation of the Waste Isolation Pilot Plan and supporting programs to provide disposal services to these generator sites.

The disposal of legacy and newly generated low-level waste and mixed low-level waste reflects the intensity of cleanup activities at a site. A number of sites contribute to the low-level and mixed low-level waste measure.

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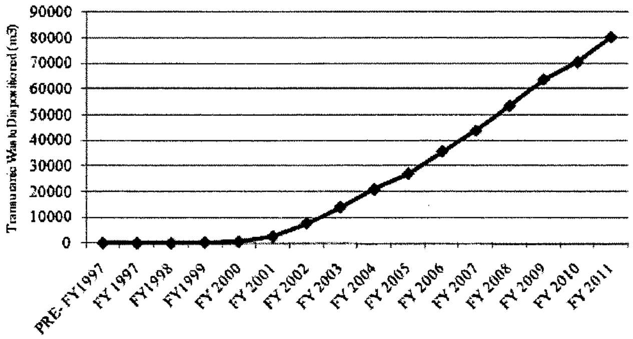
[a] Changes in the targets and life-cycle estimate for transuranic waste reflect new shipping priorities for Oak Ridge, Savannah River, and Los Alamos National Laboratory.

The two corporate measures portrayed below demonstrate progress towards EM's ultimate goal of site completion. The lifecycle totals for these measures currently include scope that will be funded by the American Recovery and Reinvestment Act. They do not, however, yet include the volumes of waste associated with the additional environmental liabilities that EM has agreed to accept from other Departmental mission programs.

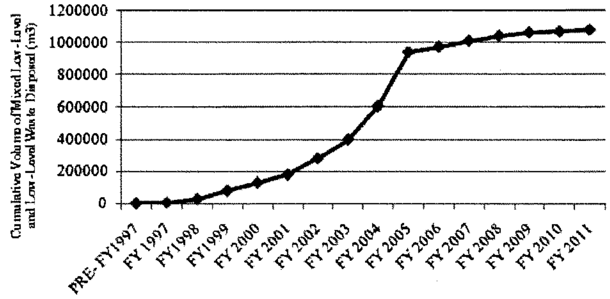
Transuranic Waste Progress

	FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
TRU Total	53,312	63,586	70,245	80,006	49%	163,720
CH-TRU	53,240	63,456	70,115	79,599	51%	156,848
RH-TRU	72	130	130	407	6%	6,872



Legacy and Newly Generated Low-Level and Mixed Low-Level Waste Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
1,044,129	1,065,098	1,070,804	1,080,923	77%	1,406,085

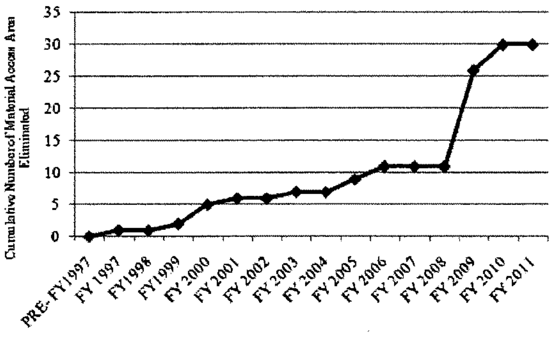


Material Access Areas

The elimination of a material access area indicates the completion of a segment of work that removes the need for safeguards and security in the area. This is an obvious indicator of a site's progress towards reducing risk to workers, the public, and the environment. The Rocky Flats Site and the Idaho National Laboratory completed all work for this measure, while Savannah River Site and Hanford Site continue to contribute to this corporate measure, which is depicted below.

Material Access Area Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
11	26	30	30	97%	31

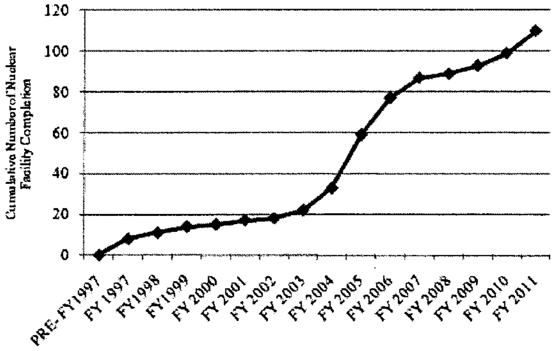


Facility Completions

Three corporate performance measures (i.e., nuclear, radioactive, and industrial facilities) encompass facility completions; measured are the number of facilities that have reached their end state within the EM program. The endpoint corresponds to one of the following: decommissioning, deactivation, dismantlement, demolishment, or responsibility for the facility is transferred to another program or owner. Facility completions are an excellent indicator of EM's progress towards site cleanup. Many sites contribute to facility completions, which are portrayed below.

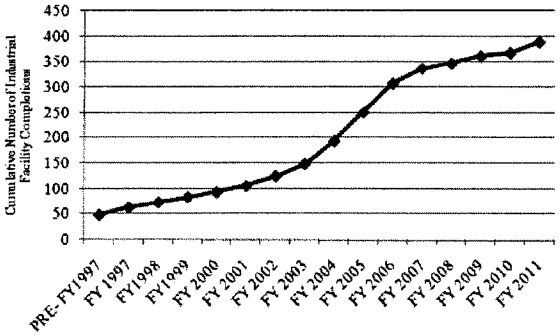
Nuclear Facility Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
89	93	99	110	23%	474



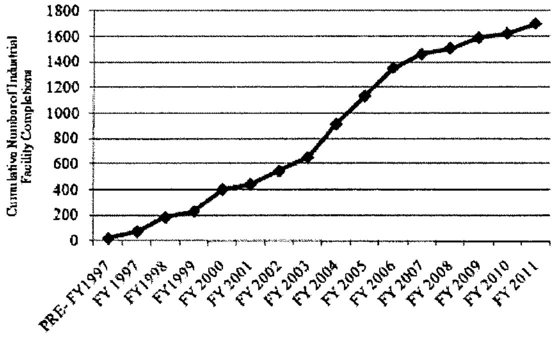
Radioactive Facility Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
348	363	369	390	37%	1,045



Industrial Facility Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
1,509	1,588	1,623	1,700	47%	3,640

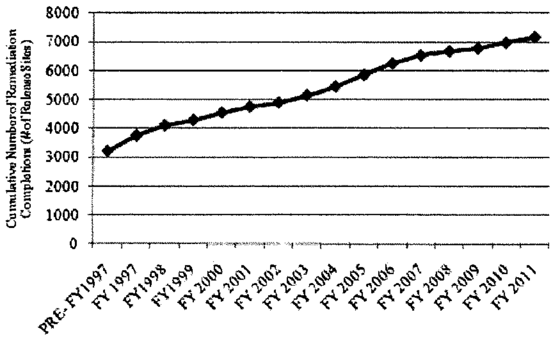


Remediation Completions

The completion of release sites, discrete areas of contamination at a site, is a good indicator of a site's progress towards completions. The measure indicates completion of the activities necessary to evaluate and alleviated the release or possible release of a hazardous substance that may pose a risk to human health or the environment. Many sites contribute to remediation completions, which are portrayed below.

Remediation Completion Progress

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	*FY2011 Cumulative Target*	% Complete Through FY2011	Life-Cycle Total
6,693	6,788	6,985	7,181	67%	10,645



Geographic Site Completions

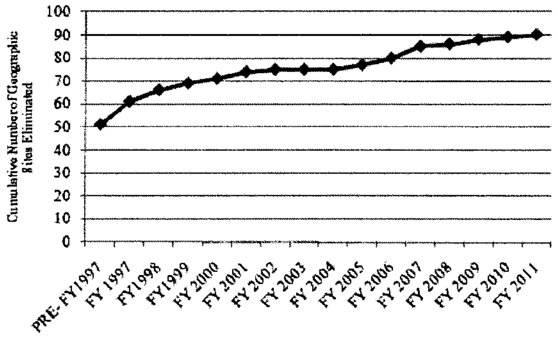
Completion of a geographic site best reflects EM's goal of accelerating cleanup and reducing risk. A geographic site is considered complete in its entirety when active remediation has been completed in accordance with the terms and conditions of cleanup agreements. Stewardship or non-EM activities may be on going after a site is completed. EM tracks cleanup responsibilities for 108 contaminated sites.

- In FY 2009 EM has completed cleanup at two sites – Pantex Plant and Argonne National Laboratory.
- In FY 2010 EM plans to complete cleanup at one site – Inhalation and Toxicology Laboratory.
- In FY 2011 EM plans to complete cleanup at four sites – General Electric Vallecitos Nuclear Center, Brookhaven National Laboratory, Stanford Linear Accelerator Center and Separations Process Research Unit.

In order to complete a geographic site (e.g., Fernald), EM must complete remediation of all release sites present at the site. This corporate performance measure that indicates the level of completion for the EM program is shown below.

Geographic Sites Eliminated

FY2008 Cumulative Actual	FY2009 Cumulative Actual	FY2010 Cumulative Target	FY2011 Cumulative Target	% Complete Through FY2011	Life-Cycle Total
86	88	89	90	86%	107



Means and Strategies

The EM program will pursue the following means and strategies to achieve its program goals:

- Eliminate significant environmental, health and safety risks as soon as possible.
  - High-level waste/tank waste stabilization, treatment, disposal
  - Spent nuclear fuel storage, receipt, disposition
  - Special nuclear material consolidation, processing and disposition
  - Higher risk soil and groundwater remediation
  - Solid waste (transuranic waste and low-level waste/mixed low-level waste) storage, treatment, disposal
  - Soil and groundwater remediation
  - Decontamination and decommissioning of excess facilities
- Hold cleanup contractors accountable to high safety standards; and empower them to pursue the most direct path to success.
- Acquisition strategies will promote contractor efficiencies through competition, performance incentives and through use of appropriate contracting vehicles (such as Indefinite Delivery/ Indefinite Quantity).
- Perform risk reduction and site closure in concert with regulators and stakeholders to determine the most appropriate remediation schedules and approaches.
- Project contingency funding will not be requested with the exception of capital projects. Unexpected project expenditures will reduce planned annual project performance.
- Streamline EM program activities to focus on risk reduction and cleanup.

- Continue to revitalize human capital as it is only with well-trained and qualified people that EM will be able to accomplish its cleanup mission.

The following external factors could affect EM's ability to achieve its strategic goal:

- Cleanup Standards: The end state for cleanup at certain sites is not fully determined. The extent of cleanup greatly affects cost, schedule and scope of work.
- Uncertain Work Scope: Uncertainties are inherent in the environmental cleanup program due to the complexity and nature of the work. There are uncertainties in EM's knowledge of the types of contaminants, their extent, and concentrations.
- Commercially Available Options for Waste Disposition: Accomplishment of risk reduction and site closure is dependent upon the continued availability of commercial options for mixed low-level waste and low-level waste treatment and disposal.
- Constrained Flexibility: New regulations, statutes, orders, or litigation may constrain the program's flexibility in accomplishing the goal of cleanup completion and risk reduction in a fiscally responsible manner. EM will be given sufficient flexibility by Congress to execute its budget efficiently within established appropriation control points.
- Waste Incidental to Reprocessing: EM can proceed with key aspects of its planned tank waste programs consistent with the FY 2005 authorization legislation and current status of the litigation related to waste incidental to reprocessing.
- New Mission or Responsibilities: EM will not initiate additional work scope, associated with cleanup of excess facilities from other DOE programs, until there is room within EM's budget based on risk reduction and business case priorities to accomplish this new work scope or the other DOE programs transfer budget target to EM.

In carrying out the program's risk reduction and cleanup mission, EM performs a variety of collaborative activities:

- Regulatory Compliance: DOE negotiates and executes environmental compliance and cleanup agreements with the U.S. Environmental Protection Agency and state regulatory agencies, as appropriate. Key parameters such as required cleanup levels and milestones must be negotiated with the appropriate regulators and stakeholders for each site. Compliance with environmental laws and agreements continues to be a major cost driver for the EM program.
- Defense Nuclear Facilities Safety Board: EM works with the Board to implement recommendations relating to activities at the Department's nuclear facilities affecting nuclear health and safety.
- Environmental Management Advisory Board: EM solicits advice and guidance from the EM Advisory Board on a wide variety of topics, with special emphasis on difficult corporate issues relative to cleanup.
- EM Site Specific Advisory Boards: EM solicits advice and guidance on site operations from nine Site Specific Advisory Boards across the EM complex.
- National Academy of Public Administration (NAPA): EM works with NAPA on its recommendations regarding organization, managerial and human capital issues.
- National Academy of Science (NAS): EM works with the NAS on its recommendations regarding various technical and scientific issues confronting the EM program.

EM also solicits advice and guidance from other external liaison groups, including the National Governors' Association, National Association of Attorney's General, State and Tribal Governments Working Group, Energy Communities Alliance, and the Environmental Council of the States.

Validation and Verification

To validate and verify program performance, EM will conduct various internal and external reviews and audits. EM's programmatic activities are subject to continuing reviews by the Congress, the Government Accountability Office, the Department's Inspector General, the Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, state environmental and health agencies, the Defense Nuclear Facilities Safety Board, and the Department's Office of Engineering and Construction Management. Each year, the Office of Engineering and Construction Management conducts external independent reviews of selected projects. In addition, various Operations/Field Offices commission external independent reviews of site baselines or portions of both operating and construction project baselines. Additionally, EM Headquarters senior management and Field managers conduct quarterly, in-depth reviews of cost, schedule, and scope to ensure projects are on-track and within budget. Headquarters offices conduct routine assessments of baseline performance.

Corporate Performance Measures – EM Totals[a]

	Complete Through FY 2009	Cumulative FY 2010 Target	Cumulative FY 2011 Target	Cumulative FY 2012 Target
Geographic Sites Eliminated (number of sites)	88	89	90	91
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	5,089	5,089	5,089	5,089
Enriched Uranium packaged for disposition (Number of Containers)	7,629	7,728	7,728	7,728
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	107,828	107,828	107,828	107,828
Depleted and Other Uranium packaged for disposition (Metric Tons)	14,636	14,636	32,186	65,822
Liquid Waste in Inventory eliminated (Thousands of Gallons)	2,924	3,624	4,424	5,924
Liquid Waste Tanks closed (Number of Tanks)	9	9	11	18
High-Level Waste packaged for final disposition (Number of Containers)	3,070	3,256	3,553	3,677
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	2,128	2,128	2,128	2,133
Transuranic Waste shipped for disposal (Cubic meters) - CH	63,456	70,115	79,599	89,874
Transuranic Waste shipped for disposal (Cubic meters) - RH	130	130	407	819
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,065,098	1,070,804	1,080,923	1,090,931
Material Access Areas eliminated (Number of Material Access Areas)	26	30	30	31
Nuclear Facility Completions (Number of Facilities)	93	99	110	112
Radioactive Facility Completions (Number of Facilities)	363	369	390	429
Industrial Facility Completions (Number of Facilities)	1,588	1,623	1,700	1,811
Remediation Complete (Number of Release Sites)	6,788	6,985	7,181	7,394

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[a] Performance measures are currently being updated.

Life-cycle Costs

As part of its application of DOE Order 413.3A to operating expense-funded cleanup projects, EM identifies contingency that increases the probable project cost with a resulting higher confidence level (from a nominal 50% confidence level to 80% confidence level) that the project can be completed on time at the estimated cost. EM's budget request does not include any contingency funding to support this higher confidence.

The EM program has developed life-cycle estimates with cost and schedule ranges to account for the uncertainty associated with long-term project execution. These ranges have been reviewed independently for reasonableness by the DOE Office of Engineering and Construction Management. These ranges represent EM's best estimate for life-cycle cost. In instances where a project has not been reviewed or is complete, a single point estimate or actual cost is provided. The life-cycle costs represent active projects at EM sites and those sites completed prior to FY 2009 that are transitioning to the Office of Legacy Management or other program landlords for long-term stewardship. In addition, the life-cycle cost ranges include prior year costs beginning in FY 1997 through FY 2009.

ENVIRONMENTAL MANAGEMENT PROGRAM LIFE-CYCLE COST RANGE
(Millions of Dollars)

Site	LCC Total Range		
Argonne National Laboratory-East	$78	-	
Ashtabula	137	-	
Brookhaven National Laboratory	435	-	469
Columbus	172	-	
Energy Technology Engineering Center	345	-	394
Fernald	3,495	-	
Hanford Site	58,523	-	61,285
Headquarters	2,291	-	
Idaho National Laboratory	26,248	-	32,881
Inhalation Toxicology Laboratory	11	-	
Kansas City Plant	30	-	
Laboratory for Energy-Related Health Research	40	-	
Lawrence Berkeley National Laboratory	36	-	
Lawrence Livermore National Laboratory	330	-	
Los Alamos National Laboratory	2,647	-	3,593
Miamisburg	1,945	-	
Moab	1,000	-	1,040
Nevada Test Site	2,443	-	2,750
Oak Ridge Reservation	10,078	-	10,553
Office of River Protection	56,784	-	74,687
Other	1,401	-	1,404
Paducah Gaseous Diffusion Plant	10,241	-	17,062
Pantex Plant	208	-	
Portsmouth Gaseous Diffusion Plant	9,199	-	16,092
Program Direction	12,080	-	
Rocky Flats Environmental Technology Site	9,047	-	
Sandia National Laboratory	235	-	

ENVIRONMENTAL MANAGEMENT PROGRAM LIFE-CYCLE COST RANGE (Millions of Dollars)			
Savannah River Site	53,286	-	64,120
Stanford Linear Accelerator Center	52	-	54
Technology Development and Deployment	3,073	-	
Waste Isolation Pilot Plant	6,832	-	7,393
West Valley Demonstration Project	1,849	-	1,987
TOTAL EM PROGRAM	$274,569	-	$328,974

Site Closure Dates

EM's lifecycle cost estimates reflect a range of site completion dates. This range is shown on the following table. In instances where a project has not been reviewed or is complete, a single point estimate or actual date is provided. Note that the dates in the table are based on fiscal years to conform with the budget cycle. Changes from the FY 2010 Congressional Request are discussed in each site's budget narrative.

ENVIRONMENTAL MANAGEMENT PROJECT SCHEDULE RANGE	
Site	Completion Date
Pantex Plant	2009*
Argonne National Laboratory - East	2009*
Inhalation Toxicology Laboratory	2010
General Electric Vallecitos Nuclear Center	2011
Stanford Linear Accelerator Center	2012**
Separations Process Research Unit	2013 - 2014**
Sandia National Laboratories - NM	2014
Lawrence Livermore National Laboratory - Site 300	2014
West Valley Demonstration Project	2018
Los Alamos National Laboratory	2019
Energy Technology Engineering Center	2018 - 2025
Brookhaven National Laboratory	2018 - 2020**
Oak Ridge Reservation	2021 - 2022
Nevada Test Site Projects	2027 - 2038
Moab	2028
Savannah River Site	2038 - 2040
Idaho National Laboratory	2035 - 2044
Waste Isolation Pilot Plant	2035 - 2039
Paducah Gaseous Diffusion Plant	2040 - 2052
Portsmouth Gaseous Diffusion Plant	2044 - 2052
Hanford Site	2050 - 2062

*Physical completion occurred in FY 2009. Critical Decision 4 paperwork expected to be signed in first quarter, CY 2010.

** With ARRA funding the completion date for these sites are expected to be accelerated to FY 2011.

Facilities Maintenance and Repair

The Department's Facilities Maintenance and Repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded by this budget are displayed below.

Direct-Funded Maintenance and Repair[a]

	(dollars in thousands)		
		FY 2010	FY 2011
Carlsbad	$16,189	$14,483	$14,465
Oak Ridge	18,314	9,397	6,172
Idaho National Laboratory	32,737	31,103	28,598
Paducah	3,336	3,697	4,283
Portsmouth	8,763	3,398	3,823
Richland Operations Office	50,214	42,796	40,158
Office of River Protection	27,794	27,335	45,622
Savannah River	129,703	133,910	149,782
	$287,050	$266,119	$292,903

Indirect-Funded Maintenance and Repair

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Carlsbad	$0	$0	$0
Oak Ridge	0	0	0
Idaho National Laboratory	0	0	0
Paducah	0	0	0
Portsmouth	0	0	0
Richland Operations Office	0	0	0
Office of River Protection	0	0	0
Savannah River	15,738	16,256	17,108
	$15,738	$16,256	$17,108

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[a] Data is as of fourth quarter FY 2009.

ANCILLARY TABLES

Detailed Funding Table

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Defense Environmental Cleanup			
Closure Sites			
Operating	45,883	41,468	6,375
Hanford Site			
2012 Accelerated Completions			
Operating	476,491	541,367	0
River Corridor and Other Cleanup Operations			
Operating	0	0	545,289
2035 Accelerated Completions			
Operating	490,485	448,713	0
Central Plateau Remediation			
Operating	0	0	423,640
Total, Hanford Site	966,976	990,080	968,929
Idaho National Laboratory			
Operating	389,061	370,468	400,600
Construction:			
06-D-401 / Sodium Bearing Waste Treatment Project, Idaho National Laboratory (INL), Idaho	86,700	93,700	6,500
Total, Idaho National Laboratory	475,761	464,168	407,100
NNSA Sites			
Operating	322,539	284,124	279,373
Oak Ridge			
Operating	262,835	178,768	202,298
Office of River Protection			
Waste Treatment and Immobilization Plant			
Construction:			
01-D-16A / Low Activity Waste Facility, RL	160,000	0	0
01-D-16-A-D / Waste Treatment and Immobilization Plant - Sub-Projects A-D, RL	0	365,000	370,178
01-D-16B / Analytical Laboratory, RL	65,000	0	0
01-D-16C / Balance of Facilities, RL	75,000	0	0
01-D-16D / High Level Waste Facility, RL	125,000	0	0
01-D-16E / Pretreatment Facility, RL	265,000	325,000	370,000
Total, Construction	690,000	690,000	740,178
Tank Farm Activities			
Operating	319,943	408,000	418,000
Total, Office of River Protection	1,009,943	1,098,000	1,158,178
Savannah River Site			
Nuclear Material Stabilization and Disposition			
Operating	361,343	385,310	0
Cleanup and Waste Disposition			
Operating	0	0	18,330
2035 Accelerations			
Operating	129,626	57,068	0
Construction:			
08-D-414 / 08-D-414: Plutonium Preparation Project, Savannah River Site (SRS), Aiken, South Carolina (SR-0011C)	0	6,315	0

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Total, 2035 Accelerations	129,626	63,383	0
Site Risk Management Operations			
Operating	0	0	942,518
Construction:			
05-D-405 / Salt Waste Processing Facility, SR	155,524	234,118	256,951
Total, Site Risk Management Operations	155,524	234,118	1,199,469
Tank Farm Activities			
Operating	576,250	527,138	0
Total, Savannah River Site	1,222,743	1,209,949	1,217,799
Waste Isolation Pilot Plant			
Operating	231,661	230,337	220,245
Program Support			
Operating	33,930	34,000	25,143
Program Direction			
Operating	309,807	345,000	323,825
Safeguards and Security			
Operating	266,141	279,437	249,754
Technology Development and Deployment			
Operating	31,415	20,000	32,320
Federal Contribution to the Uranium Enrichment D&D Fund			
Operating	463,000	463,000	496,700
Congressionally Directed Projects			
Operating	17,908	4,000	0
Total, Defense Environmental Cleanup	5,660,542	5,642,331	5,588,039
Non-Defense Environmental Cleanup			
Fast Flux Test Reactor Facility D&D			
Operating	10,755	7,652	3,659
Congressionally Directed Projects			
Operating	4,757	0	0
Gaseous Diffusion Plants			
Operating	48,296	100,885	99,464
Construction:			
02-U-101 / Depleted Uranium Hexafluoride Conversion Project, Paducah, KY & Portsmouth, OH	33,000	0	0
Total, Gaseous Diffusion Plants	81,296	100,885	99,464
Small Sites			
Operating	110,436	88,062	63,966
West Valley Demonstration Project			
Operating	65,500	58,074	58,074
Total, Non-Defense Environmental Cleanup	272,744	254,673	225,163
Uranium Enrichment Decontamination and Decommissioning Fund			
D&D Activities			
Operating	525,503	573,850	730,498
U/Th Reimbursements			
Operating	10,000	0	0
Total, Uranium Enrichment Decontamination and Decommissioning Fund	535,503	573,850	730,498

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Total, Environmental Management	6,468,789	6,470,854	6,543,700
Use of Prior Year (Defense Environmental Cleanup)	-4,197	0	0
Use of Prior year (Non-Defense Environmental Cleanup)	-925	0	0
Transfer from Office of Science	-10,000	0	0
D&D Fund Offset	-463,000	-463,000	-496,700
Total, Environmental Management	5,990,667	6,007,854	6,047,000

Funding Summary by Office

(dollars in thousands)

Site	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Carlsbad	231,661	230,337	220,245
Idaho	489,239	469,168	412,000
Oak Ridge	471,668	403,768	432,700
Paducah	161,751	163,937	136,504
Portsmouth	236,215	285,798	463,056
Richland	977,731	997,732	972,588
River Protection	1,009,943	1,098,000	1,158,178
Savannah River	1,222,743	1,209,949	1,217,799
NNSA Sites	324,444	284,124	279,373
Closure Sites	45,883	41,468	6,375
All Other Sites	95,053	83,062	59,066
Safeguards and Security	266,141	279,437	249,754
Headquarters Operations	66,595	38,000	25,143
West Valley Demonstration Project	65,500	58,074	58,074
Technology Development & Deployment	31,415	20,000	32,320
Program Direction	309,807	345,000	323,825
D&D Fund Deposit	463,000	463,000	496,700
Subtotal, Environmental Management	6,468,789	6,470,854	6,543,700
Offsets	-478,122	-463,000	-496,700
Total, Environmental Management	5,990,667	6,007,854	6,047,000

Environmental Management Federal Staffing

(Full-Time Equivalents)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Carlsbad	45	50	50
Idaho	69	70	70
Oak Ridge	80	82	82
Portsmouth/Paducah Project Office	47	48	48
Richland	264	275	275
River Protection	134	145	145
Savannah River	331	345	345
Small Sites	32	32	32
Nevada Site Office	24	25	25
NNSA Sites	32	28	28
EM Career Development Corp	39	40	40
Subtotal, Field, Full-Time Equivalents	1,097	1,140	1,140
Headquarters Operations	329	344	344
Consolidated Business Center	175	190	190
Total, Field, Full-Time Equivalents	1,601	1,674	1,674

Funding by Office/Site/Location

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Carlsbad			
Carlsbad Field Office	26,909	27,854	28,771
Waste Isolation Pilot Plant	204,752	202,483	191,474
Total, Carlsbad	231,661	230,337	220,245
Idaho			
Idaho National Laboratory	489,239	469,168	412,000
Oak Ridge			
East Tennessee Technology Park	208,938	225,100	230,489
Oak Ridge National Laboratory	129,125	83,300	108,102
Oak Ridge Reservation	95,513	41,868	30,334
Y-12 Plant	38,092	53,500	63,775
Total, Oak Ridge	471,668	403,768	432,700
Paducah			
Paducah Gaseous Diffusion Plant	161,751	163,937	136,504
Portsmouth			
Portsmouth Gaseous Diffusion Plant	236,215	285,798	463,056
Richland			
Hanford Site	958,111	975,792	952,968
Richland Operations Office	19,620	21,940	19,620
Total, Richland	977,731	997,732	972,588
River Protection			
River Protection	1,009,943	1,098,000	1,158,178
Savannah River			
Savannah River National Laboratory	58,500	61,480	61,000
Savannah River Operations Office	19,800	18,300	18,330
Savannah River Site	1,144,443	1,130,169	1,138,469
Total, Savannah River	1,222,743	1,209,949	1,217,799
NNSA Sites			
California Site Support	0	238	238
Lawrence Livermore National Laboratory	688	910	635
Los Alamos National Laboratory	224,639	196,500	196,953
Nevada Test Site	75,674	65,674	66,000
NNSA Service Center	1,443	2,938	3,047
Pantex Plant	1,000	0	0
Sandia National Laboratory	3,000	2,864	0
Separations Process Research Unit	18,000	15,000	12,500
Total, NNSA Sites	324,444	284,124	279,373

	(dollars in thousands)		
	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Closure Sites			
Consolidated Business Center	13,209	8,225	6,375
Fernald	2,100	0	0
Miamisburg	30,574	33,243	0
Total, Closure Sites	45,883	41,468	6,375
All Other Sites			
Argonne National Laboratory-East	19,479	10,000	0
Brookhaven National Laboratory	8,433	15,000	13,861
California Site Support	187	262	0
Consolidated Business Center	1,100	1,200	0
Energy Technology Engineering Center	15,000	10,500	10,679
Inhalation Toxicology Laboratory	272	0	0
Moab	40,699	39,000	31,000
SLAC National Accelerator Laboratory	4,883	7,100	3,526
Tuba City	5,000	0	0
Total, All Other Sites	95,053	83,062	59,066
Safeguards and Security			
Carlsbad Field Office	5,124	4,644	4,755
East Tennessee Technology Park	27,020	32,400	17,300
Hanford Site	79,765	82,771	69,234
Paducah Gaseous Diffusion Plant	8,196	8,190	8,496
Portsmouth Gaseous Diffusion Plant	4,500	17,509	15,979
Savannah River Site	138,736	132,064	132,064
West Valley Demonstration Project	2,800	1,859	1,926
Total, Safeguards and Security	266,141	279,437	249,754
Headquarters Operations			
Congressionally Directed Projects	22,665	4,000	0
Headquarters	43,930	34,000	25,143
Total, Headquarters Operations	66,595	38,000	25,143
West Valley Demonstration Project			
West Valley Demonstration Project	65,500	58,074	58,074
Technology Development & Deployment			
Technology Development and Deployment	31,415	20,000	32,320
Program Direction			
Program Direction	309,807	345,000	323,825
D&D Fund Deposit			
D&D Fund Deposit	463,000	463,000	496,700
Total, Environmental Management	6,468,789	6,470,854	6,543,700
Use of Prior Year (Defense Environmental Cleanup)	-4,197	0	0
Use of Prior year (Non-Defense Environmental Cleanup)	-925	0	0
Transfer from Office of Science	-10,000	0	0
D&D Fund Offset	-463,000	-463,000	-496,700
Total, Environmental Management	5,990,667	6,007,854	6,047,000

Corporate Measures Totals by Site [a]

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
All Other Sites					
Ames Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Argonne National Laboratory-East					
Geographic Sites Eliminated (number of sites)	0	1	1	1	1
Radioactive Facility Completions (Number of Facilities)	69	78	78	78	80
Remediation Complete (Number of Release Sites)	443	443	443	443	443
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	30
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	22
Brookhaven National Laboratory					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Nuclear Facility Completions (Number of Facilities)	0	0	1	1	1
Radioactive Facility Completions (Number of Facilities)	10	10	11	11	11
Remediation Complete (Number of Release Sites)	77	77	77	77	77
California Site Support					
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	272	272	272	272	272
Remediation Complete (Number of Release Sites)	3	3	3	3	3
Chicago Operations Office					
Geographic Sites Eliminated (number of sites)	3	3	3	3	3
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	537	537	537	537	537
Remediation Complete (Number of Release Sites)	30	30	30	30	30
Energy Technology Engineering Center					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Industrial Facility Completions (Number of Facilities)	24	24	24	24	26
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,055	1,055	1,055	1,055	1,080
Radioactive Facility Completions (Number of Facilities)	4	4	4	4	6
Remediation Complete (Number of Release Sites)	4	4	4	4	14

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[a] Life-cycle estimates for release sites, facilities, and high-level waste containers include pre-1997 actuals. Quantities for all other measures except low-level and mixed low-level waste disposal begin in 1997. Low-level and mixed low-level waste disposal begins in 1998.

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
Fermi National Accelerator Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
General Atomics					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,716	1,716	1,716	1,716	1,716
Remediation Complete (Number of Release Sites)	2	2	2	2	2
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	1	1	1	1	1
General Electric					
Geographic Sites Eliminated (number of sites)	0	0	0	1	1
Geothermal Test Facility					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Grand Junction					
Geographic Sites Eliminated (number of sites)	2	2	2	2	2
Inhalation Toxicology Laboratory					
Geographic Sites Eliminated (number of sites)	0	0	1	1	1
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	359	359	359	359	359
Remediation Complete (Number of Release Sites)	9	9	9	9	9
Laboratory for Energy-Related Health Research					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Industrial Facility Completions (Number of Facilities)	1	1	1	1	1
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	944	944	944	944	944
Remediation Complete (Number of Release Sites)	16	16	16	16	16
Lawrence Berkeley National Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Remediation Complete (Number of Release Sites)	181	181	181	181	181
Moab					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
New Mexico Site Support					
Geographic Sites Eliminated (number of sites)	5	5	5	5	5
Princeton Plasma Physics Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
South Valley					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Stanford Linear Accelerator Center					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Remediation Complete (Number of Release Sites)	17	17	32	51	51

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
UMTRA					
Geographic Sites Eliminated (number of sites)	24	24	24	24	24
Oak Ridge					
East Tennessee Technology Park					
Industrial Facility Completions (Number of Facilities)	288	316	338	355	595
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	38,250	38,346	38,346	38,346	39,676
Nuclear Facility Completions (Number of Facilities)	6	6	6	6	8
Radioactive Facility Completions (Number of Facilities)	8	8	10	10	30
Remediation Complete (Number of Release Sites)	91	103	122	123	167
FUSRAP					
Geographic Sites Eliminated (number of sites)	25	25	25	25	25
Oak Ridge National Laboratory					
Industrial Facility Completions (Number of Facilities)	7	7	7	7	28
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	366	811	1,160	1,487	4,518
Nuclear Facility Completions (Number of Facilities)	0	0	0	0	15
Radioactive Facility Completions (Number of Facilities)	3	3	3	3	31
Remediation Complete (Number of Release Sites)	80	80	80	80	177
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	24
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	198
Oak Ridge Operations Office					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Industrial Facility Completions (Number of Facilities)	3	3	3	3	3
Remediation Complete (Number of Release Sites)	84	84	97	97	97
Oak Ridge Reservation					
Geographic Sites Eliminated (number of sites)	1	1	1	1	2
Industrial Facility Completions (Number of Facilities)	2	2	2	2	2
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	60,509	61,505	62,191	64,481	78,198
Nuclear Facility Completions (Number of Facilities)	2	2	2	2	2
Radioactive Facility Completions (Number of Facilities)	15	15	15	15	15
Remediation Complete (Number of Release Sites)	112	113	114	114	114
Transuranic Waste shipped for disposal (Cubic meters) - CH	16	81	81	81	1,449
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	5	5	5	550

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
Weldon Spring Site					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Y-12 Plant					
Industrial Facility Completions (Number of Facilities)	1	1	1	1	7
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	16,252	16,252	16,252	16,252	59,290
Remediation Complete (Number of Release Sites)	28	28	28	28	138
NNSA Sites					
Kansas City Plant					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Remediation Complete (Number of Release Sites)	43	43	43	43	43
Lawrence Livermore National Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	2
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	2,766	2,766	2,766	2,766	2,766
Remediation Complete (Number of Release Sites)	194	194	194	194	194
Transuranic Waste shipped for disposal (Cubic meters) - CH	125	125	125	125	125
Los Alamos National Laboratory					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	5,993	7,308	7,533	8,810	10,247
Radioactive Facility Completions (Number of Facilities)	0	0	0	1	105
Remediation Complete (Number of Release Sites)	1,417	1,426	1,456	1,548	2,089
Transuranic Waste shipped for disposal (Cubic meters) - CH	2,095	2,350	3,309	6,472	12,866
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	16	16	16	94
Nevada Test Site					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Remediation Complete (Number of Release Sites)	1,017	1,061	1,062	1,065	2,037
Transuranic Waste shipped for disposal (Cubic meters) - CH	449	1,246	1,246	1,246	1,246
New Mexico Site Support					
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,319	1,319	1,319	1,319	1,319
Remediation Complete (Number of Release Sites)	155	155	155	155	155
NNSA Service Center					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Nuclear Facility Completions (Number of Facilities)	0	0	0	1	4
Remediation Complete (Number of Release Sites)	0	0	4	5	6
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	50	50

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
Offsites					
Geographic Sites Eliminated (number of sites)	3	3	3	3	3
Remediation Complete (Number of Release Sites)	53	53	53	53	53
Pantex Plant					
Geographic Sites Eliminated (number of sites)	0	1	1	1	1
Industrial Facility Completions (Number of Facilities)	4	4	4	4	4
Remediation Complete (Number of Release Sites)	237	237	237	237	237
Sandia National Laboratory					
Geographic Sites Eliminated (number of sites)	1	1	1	1	2
Radioactive Facility Completions (Number of Facilities)	1	1	1	1	1
Remediation Complete (Number of Release Sites)	263	263	264	264	264
Idaho					
Argonne National Laboratory - West					
Remediation Complete (Number of Release Sites)	37	37	37	37	37
Argonne National Laboratory-West					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Idaho National Laboratory					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Enriched Uranium packaged for disposition (Number of Containers)	1,586	1,586	1,586	1,586	1,586
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	0	6,660
Industrial Facility Completions (Number of Facilities)	138	143	143	143	255
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	100	900
Liquid Waste Tanks closed (Number of Tanks)	7	7	7	7	11
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	66,599	67,688	69,518	71,568	109,114
Material Access Areas eliminated (Number of Material Access Areas)	1	1	1	1	1
Nuclear Facility Completions (Number of Facilities)	24	28	28	28	92
Radioactive Facility Completions (Number of Facilities)	32	35	35	35	68
Remediation Complete (Number of Release Sites)	240	250	329	333	366
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	0	0	0	0	253
Transuranic Waste shipped for disposal (Cubic meters) - CH	26,798	35,423	41,123	46,823	83,155
Transuranic Waste shipped for disposal (Cubic meters) - RH	72	92	92	92	117
Idaho Operations Office					
Remediation Complete (Number of Release Sites)	233	233	233	233	233

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
Maxey Flats					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Monticello Remedial Action Project					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Pinellas Plant					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Closure Sites					
Ashtabula					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Industrial Facility Completions (Number of Facilities)	7	7	7	7	7
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	3,707	3,707	3,707	3,707	3,707
Radioactive Facility Completions (Number of Facilities)	28	28	28	28	28
Remediation Complete (Number of Release Sites)	3	3	3	3	3
Columbus					
Geographic Sites Eliminated (number of sites)	2	2	2	2	2
Nuclear Facility Completions (Number of Facilities)	1	1	1	1	1
Radioactive Facility Completions (Number of Facilities)	14	14	14	14	14
Remediation Complete (Number of Release Sites)	2	2	2	2	2
Fernald					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Industrial Facility Completions (Number of Facilities)	1	1	1	1	1
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	7,085	7,085	7,085	7,085	7,085
Radioactive Facility Completions (Number of Facilities)	29	29	29	29	29
Remediation Complete (Number of Release Sites)	6	6	6	6	6
Miamisburg					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	0	0
Industrial Facility Completions (Number of Facilities)	116	116	116	116	116
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	3,947	3,947	3,947	3,947	3,947
Nuclear Facility Completions (Number of Facilities)	8	8	8	8	8
Radioactive Facility Completions (Number of Facilities)	11	11	11	11	11
Remediation Complete (Number of Release Sites)	178	178	178	178	178
Rocky Flats Environmental Technology Site					
Geographic Sites Eliminated (number of sites)	1	1	1	1	1
Industrial Facility Completions (Number of	317	317	317	317	317

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
Facilities)					
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	602,188	602,188	602,188	602,188	602,188
Material Access Areas eliminated (Number of Material Access Areas)	7	7	7	7	7
Nuclear Facility Completions (Number of Facilities)	6	6	6	6	6
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	1,895	1,895	1,895	1,895	1,895
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	103,901	103,901	103,901	103,901	103,901
Radioactive Facility Completions (Number of Facilities)	54	54	54	54	54
Remediation Complete (Number of Release Sites)	360	360	360	360	360
Transuranic Waste shipped for disposal (Cubic meters) - CH	15,036	15,036	15,036	15,036	15,036
West Valley Demonstration Project					
West Valley Demonstration Project					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
High-Level Waste packaged for final disposition (Number of Containers)	275	275	275	275	275
Industrial Facility Completions (Number of Facilities)	13	13	14	29	29
Liquid Waste in Inventory eliminated (Thousands of Gallons)	814	814	814	814	814
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	26,931	27,986	27,986	29,899	29,899
Nuclear Facility Completions (Number of Facilities)	3	3	4	12	14
Radioactive Facility Completions (Number of Facilities)	4	4	4	6	13
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	571	1,142
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	277	555
Portsmouth					
Portsmouth Gaseous Diffusion Plant					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	9,800	252,800
Industrial Facility Completions (Number of Facilities)	7	8	8	8	121
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	31,907	35,754	35,754	35,754	35,754
Nuclear Facility Completions (Number of Facilities)	0	0	0	0	13
Radioactive Facility Completions (Number of Facilities)	7	7	7	7	27
Remediation Complete (Number of Release Sites)	150	150	150	150	151
Paducah					
Paducah Gaseous Diffusion Plant					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Depleted and Other Uranium packaged for	0	0	0	7,750	457,750

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
disposition (Metric Tons)					
Enriched Uranium packaged for disposition (Number of Containers)	0	0	0	0	182
Industrial Facility Completions (Number of Facilities)	12	17	17	19	172
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	15,642	19,150	19,896	20,642	26,608
Nuclear Facility Completions (Number of Facilities)	0	0	0	0	19
Radioactive Facility Completions (Number of Facilities)	2	2	2	3	22
Remediation Complete (Number of Release Sites)	94	94	109	125	217
Savannah River					
Savannah River Site					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Depleted and Other Uranium packaged for disposition (Metric Tons)	9,974	11,536	11,536	11,536	23,182
Enriched Uranium packaged for disposition (Number of Containers)	3,004	3,085	3,184	3,184	3,184
High-Level Waste packaged for final disposition (Number of Containers)	2,599	2,795	2,981	3,278	6,300
Industrial Facility Completions (Number of Facilities)	232	232	232	232	759
Liquid Waste in Inventory eliminated (Thousands of Gallons)	1,174	2,110	2,810	3,510	33,100
Liquid Waste Tanks closed (Number of Tanks)	2	2	2	4	51
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	100,620	105,564	105,564	105,564	137,579
Material Access Areas eliminated (Number of Material Access Areas)	2	2	2	2	3
Nuclear Facility Completions (Number of Facilities)	11	11	11	11	191
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	919	919	919	919	919
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	490	490	490	490	490
Radioactive Facility Completions (Number of Facilities)	8	8	8	8	40
Remediation Complete (Number of Release Sites)	361	369	369	369	515
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	3	3	3	3	40
Transuranic Waste shipped for disposal (Cubic meters) - CH	5,691	6,165	6,165	6,165	15,590
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	17	17	17	68
Carlsbad					
Waste Isolation Pilot Plant					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Richland					
Hanford Site					
Geographic Sites Eliminated (number of sites)	0	0	0	0	1
Depleted and Other Uranium packaged for	3,100	3,100	3,100	3,100	3,100

	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Life-cycle Estimates
disposition (Metric Tons)					
Enriched Uranium packaged for disposition (Number of Containers)	2,958	2,958	2,958	2,958	2,958
Industrial Facility Completions (Number of Facilities)	336	376	388	431	1,069
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	47,213	48,572	48,572	48,572	51,450
Material Access Areas eliminated (Number of Material Access Areas)	1	16	20	20	20
Nuclear Facility Completions (Number of Facilities)	28	28	32	34	82
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	2,275	2,275	2,275	2,275	2,275
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	3,437	3,437	3,437	3,437	3,437
Radioactive Facility Completions (Number of Facilities)	49	52	55	72	346
Remediation Complete (Number of Release Sites)	468	479	498	558	1,702
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	2,124	2,124	2,124	2,124	2,124
Transuranic Waste shipped for disposal (Cubic meters) - CH	3,030	3,030	3,030	3,030	24,580
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	858
River Protection					
River Protection					
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	0	9,667
Industrial Facility Completions (Number of Facilities)	0	0	0	0	128
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	0	54,000
Liquid Waste Tanks closed (Number of Tanks)	0	0	0	0	177
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	7,952	10,267	12,137	13,653	197,832
Nuclear Facility Completions (Number of Facilities)	0	0	0	0	18
Radioactive Facility Completions (Number of Facilities)	0	0	0	0	114
Remediation Complete (Number of Release Sites)	5	5	5	5	278
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	1,555
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	4,410

Corporate Measures Totals by Site (Funded by ARRA Only)

	Complete Through 2009	Complete Through 2010	Targeted Completion Through 2011
All Other Sites			
Argonne National Laboratory-East			
Radioactive Facility Completions (Number of Facilities)	0	0	2
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	13	30
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	10	22
Energy Technology Engineering Center			
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	0	10	25
Brookhaven National Laboratory			
Geographic Sites Eliminated (number of sites)	0	0	1
Stanford Linear Accelerator Center			
Geographic Sites Eliminated (number of sites)	0	0	1
Oak Ridge			
Oak Ridge National Laboratory			
Industrial Facility Completions (Number of Facilities)	0	3	4
Radioactive Facility Completions (Number of Facilities)	0	4	5
Remediation Complete (Number of Release Sites)	0	0	1
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	192
Oak Ridge Reservation			
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	822	1,277
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	74	209
Y-12 Plant			
Industrial Facility Completions (Number of Facilities)	0	0	5
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	415	5,096	42,800
Remediation Complete (Number of Release Sites)	0	0	1
NNSA Sites			
Los Alamos National Laboratory			
Radioactive Facility Completions (Number of Facilities)	1	16	20

	Complete Through 2009	Complete Through 2010	Targeted Completion Through 2011
Remediation Complete (Number of Release Sites)	0	0	1
Nevada Test Site			
Remediation Complete (Number of Release Sites)	0	0	1
NNSA Service Center			
Separations Process Research Unit			
Geographic Sites Eliminated (number of sites)	0	0	1
Nuclear Facility Completions (Number of Facilities)	0	0	3
Remediation Complete (Number of Release Sites)	0	0	1
Idaho			
Idaho National Laboratory			
Industrial Facility Completions (Number of Facilities)	11	23	35
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,397	1,752	1,752
Nuclear Facility Completions (Number of Facilities)	8	18	31
Radioactive Facility Completions (Number of Facilities)	3	11	23
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	750	1,500
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	7	25
West Valley Demonstration Project			
West Valley Demonstration Project			
Radioactive Facility Completions (Number of Facilities)	0	0	1
Portsmouth			
Portsmouth Gaseous Diffusion Plant			
Industrial Facility Completions (Number of Facilities)	0	11	11
Radioactive Facility Completions (Number of Facilities)	0	1	1
Paducah			
Paducah Gaseous Diffusion Plant			
Nuclear Facility Completions (Number of Facilities)	0	0	1
Radioactive Facility Completions (Number of Facilities)	0	0	1
Remediation Complete (Number of Release Sites)	0	0	14
Savannah River			
Savannah River Site			
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	11,646	11,646
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	2,392	15,326	25,629
Transuranic Waste shipped for disposal (Cubic meters) - CH	180	919	2,756

	Complete Through 2009	Complete Through 2010	Targeted Completion Through 2011
Radioactive Facility Completions (Number of Facilities)	0	0	16
Transuranic Waste shipped for disposal (Cubic meters) - RH	17	22	39
Industrial Facility Completions (Number of Facilities)	0	1	2
Remediation Complete (Number of Release Sites)	0	0	9
Richland			
Hanford Site			
Industrial Facility Completions (Number of Facilities)	1	17	41
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	264	1,102	1,874
Nuclear Facility Completions (Number of Facilities)	0	1	2
Radioactive Facility Completions (Number of Facilities)	2	11	18
Remediation Complete (Number of Release Sites)	3	33	65
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	643	2,468

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Argonne National Laboratory-East	CH-ANLE-0030	Soil and Water Remediation-Argonne National Laboratory-East	30,171	0	0	30,171	30,171
Argonne National Laboratory-East	CH-ANLE-0040	Nuclear Facility D&D-Argonne National Laboratory-East	47,809	0	0	47,809	47,809
Argonne National Laboratory-East Total			77,980	0	0	77,980	77,980
Ashtabula	OH-AB-0030	Soil and Water Remediation-Ashtabula	137,340	0	0	137,340	137,340
Ashtabula Total			137,340	0	0	137,340	137,340
Brookhaven National Laboratory	BRNL-0030	Soil and Water Remediation-Brookhaven National Laboratory	230,027	36,822	36,822	266,849	266,849
Brookhaven National Laboratory	BRNL-0040	Nuclear Facility D&D-Brookhaven Graphite Research Reactor	92,019	18,120	25,311	110,139	117,330
Brookhaven National Laboratory	BRNL-0041	Nuclear Facility D&D-High Flux Beam Reactor	33,316	21,846	48,454	55,162	81,770
Brookhaven National Laboratory	BRNL-0100	Brookhaven Community and Regulatory Support	2,595	0	0	2,595	2,595
Brookhaven National Laboratory Total			357,957	76,788	110,587	434,745	468,544
Columbus	OH-CL-0040	Nuclear Facility D&D-West Jefferson	171,771	0	0	171,771	171,771
Columbus Total			171,771	0	0	171,771	171,771
Energy Technology Engineering Center	CBC-ETEC-0040	Nuclear Facility D&D-Energy Technology Engineering Center	217,047	127,556	176,855	344,603	393,902
Energy Technology Engineering Center Total			217,047	127,556	176,855	344,603	393,902
Fernald	OH-FN-0013	Solid Waste Stabilization and Disposition-Fernald	1,626,711	0	0	1,626,711	1,626,711
Fernald	OH-FN-0020	Safeguards and Security-Fernald	15,509	0	0	15,509	15,509
Fernald	OH-FN-0030	Soil and Water Remediation-Fernald	1,326,767	25,989	25,989	1,352,756	1,352,756
Fernald	OH-FN-0050	Non-Nuclear Facility D&D-Fernald	226,037	0	0	226,037	226,037

Lifecycle Costs by Program Baseline Summary (PBS)
Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Fernald	OH-FN-0100	Fernald Post-Closure Administration	0	260,536	260,536	260,536	260,536
Fernald	OH-FN-0101	Fernald Community and Regulatory Support	13,716	0	0	13,716	13,716
Fernald Total			3,208,740	286,525	286,525	3,495,265	3,495,265
Hanford Site	HQ-SNF-0012X-RL	SNF Stabilization and Disposition-Storage Operations Awaiting Geologic Repository	2,784	0	0	2,784	2,784
Hanford Site	RL-0011	NM Stabilization and Disposition-PFP	1,545,166	1,908,539	1,937,900	3,453,705	3,483,066
Hanford Site	RL-0012	SNF Stabilization and Disposition	2,171,395	802,467	829,085	2,973,862	3,000,480
Hanford Site	RL-0013C	Solid Waste Stabilization & Disposition	1,846,810	11,993,450	13,298,694	13,840,260	15,145,504
Hanford Site	RL-0020	Safeguards and Security	523,799	3,061,131	3,061,131	3,584,930	3,584,930
Hanford Site	RL-0030	Soil and Water Remediation-Groundwater/Vadose Zone	759,268	7,296,268	7,477,872	8,055,536	8,237,140
Hanford Site	RL-0040	Nuclear Facility D&D-Remainder of Hanford	1,163,064	17,888,338	18,881,900	19,051,402	20,044,964
Hanford Site	RL-0041	Nuclear Facility D&D-River Corridor Closure Project	2,023,942	2,876,300	3,034,900	4,900,242	5,058,842
Hanford Site	RL-0042	Nuclear Facility D&D-Fast Flux Test Facility Project	294,399	952,729	1,020,004	1,247,128	1,314,403
Hanford Site	RL-0043	HAMMER Facility	7,426	0	0	7,426	7,426
Hanford Site	RL-0044	B-Reactor Museum	1,876	0	0	1,876	1,876
Hanford Site	RL-0080	Operate Waste Disposal Facility	70,659	0	0	70,659	70,659
Hanford Site	RL-0100	Richland Community and Regulatory Support	180,302	1,023,906	1,023,906	1,204,208	1,204,208
Hanford Site	RL-0900	Pre-2004 Completions	128,842	0	0	128,842	128,842
Hanford Site Total			10,719,732	47,803,128	50,565,392	58,522,860	61,285,124
Headquarters	HQ-MS-0100	Policy, Management, and Technical Support	695,324	892,679	892,679	1,588,003	1,588,003
Headquarters	HQ-UR-0100	Reimbursements to Uranium/Thorium Licensees	411,849	291,398	291,398	703,247	703,247
Headquarters Total			1,107,173	1,184,077	1,184,077	2,291,250	2,291,250

Lifecycle Costs by Program Baseline Summary (PBS)
Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Idaho National Laboratory	CH-ANLW-0030	Soil and Water Remediation-Argonne National Laboratory-West	8,245	0	0	8,245	8,245
Idaho National Laboratory	HQ-SNF-0012X	SNF Stabilization and Disposition-Storage Operations Awaiting Geologic Repository	60,089	0	0	60,089	60,089
Idaho National Laboratory	HQ-SNF-0012X-ID	SNF Stabilization and Disposition-Storage Operations Awaiting Geologic Repository	18,995	0	0	18,995	18,995
Idaho National Laboratory	HQ-SNF-0012Y	SNF Stabilization and Disposition-New/Upgraded Facilities Awaiting Geologic Repository	66,844	0	0	66,844	66,844
Idaho National Laboratory	ID-0011	NM Stabilization and Disposition	19,204	0	23,000	19,204	42,204
Idaho National Laboratory	ID-0012B-D	SNF Stabilization and Disposition-2012 (Defense)	453,824	67,800	227,530	521,624	681,354
Idaho National Laboratory	ID-0012B-N	SNF Stabilization and Disposition-2012 (Non-Defense)	23,507	0	0	23,507	23,507
Idaho National Laboratory	ID-0012C	SNF Stabilization and Disposition-2035	45,651	4,354,919	5,312,459	4,400,570	5,358,110
Idaho National Laboratory	ID-0013	Solid Waste Stabilization and Disposition	2,154,939	1,061,969	1,715,969	3,216,908	3,870,908
Idaho National Laboratory	ID-0014B	Radioactive Liquid Tank Waste Stabilization and Disposition-2012	1,544,934	297,300	469,300	1,842,234	2,014,234
Idaho National Laboratory	ID-0014B-T	Radioactive Liquid Tank Waste Stabilization and Disposition-2012 (T)	71,091	0	0	71,091	71,091
Idaho National Laboratory	ID-0014C	Radioactive Liquid Tank Waste Stabilization and Disposition-2035	35,498	6,679,752	9,450,958	6,715,250	9,486,456
Idaho National Laboratory	ID-0030B	Soil and Water Remediation-2012	1,249,311	297,265	338,205	1,546,576	1,587,516
Idaho National Laboratory	ID-0030C	Soil and Water Remediation-2035	7,198	4,446,501	6,111,071	4,453,699	6,118,269
Idaho National Laboratory	ID-0040B	Nuclear Facility D&D-2012	398,072	432,700	438,650	830,772	836,722
Idaho National Laboratory	ID-0040C	Nuclear Facility D&D-2035	0	1,783,127	1,967,681	1,783,127	1,967,681
Idaho National Laboratory	ID-0050B	Non-Nuclear Facility D&D-2012	114,910	31,700	31,700	146,610	146,610

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Idaho National Laboratory	ID-0100	Idaho Community and Regulatory Support	62,279	149,940	149,940	212,219	212,219
Idaho National Laboratory	ID-0900	Pre-2004 Completions	310,261	0	0	310,261	310,261
Idaho National Laboratory Total			6,644,852	19,602,973	26,236,463	26,247,825	32,881,315
Inhalation Toxicology Laboratory	CBC-ITL-0030	Soil and Water Remediation-Inhalation Toxicology Laboratory	11,403	0	0	11,403	11,403
Inhalation Toxicology Laboratory	VL-ITL-0030	Soil and Water Remediation-Inhalation Toxicology Laboratory	13	0	0	13	13
Inhalation Toxicology Laboratory Total			11,416	0	0	11,416	11,416
Kansas City Plant	VL-KCP-0030	Soil and Water Remediation-Kansas City Plant	30,277	0	0	30,277	30,277
Kansas City Plant Total			30,277	0	0	30,277	30,277
Laboratory for Energy-Related Health Research	LEHR-0040	Nuclear Facility D&D-Laboratory for Energy-Related Health Research	39,549	0	0	39,549	39,549
Laboratory for Energy-Related Health Research	VL-LEHR-0040	Nuclear Facility D&D-Laboratory for Energy-Related Health Research	493	0	0	493	493
Laboratory for Energy-Related Health Research Total			40,042	0	0	40,042	40,042
Lawrence Berkeley National Laboratory	CBC-LBNL-0030	Soil and Water Remediation-Lawrence Berkeley National Laboratory	34,167	0	0	34,167	34,167
Lawrence Berkeley National Laboratory	VL-LBNL-0030	Soil and Water Remediation-Lawrence Berkeley National Laboratory	1,539	0	0	1,539	1,539
Lawrence Berkeley National Laboratory Total			35,706	0	0	35,706	35,706
Lawrence Livermore National Laboratory	VL-LLNL-0013	Solid Waste Stabilization and Disposition-Lawrence Livermore National Laboratory	71,822	0	0	71,822	71,822

Lifecycle Costs by Program Baseline Summary (PBS)
Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Lawrence Livermore National Laboratory	VL-LLNL-0030	Soil and Water Remediation-Lawrence Livermore National Laboratory - Main Site	136,158	0	0	136,158	136,158
Lawrence Livermore National Laboratory	VL-LLNL-0031	Soil and Water Remediation-Lawrence Livermore National Laboratory - Site 300	122,482	0	0	122,482	122,482
Lawrence Livermore National Laboratory Total			330,462	0	0	330,462	330,462
Los Alamos National Laboratory	VL-LANL-0013	Solid Waste Stabilization and Disposition-LANL Legacy	586,208	214,454	263,454	800,662	849,662
Los Alamos National Laboratory	VL-LANL-0030	Soil and Water Remediation-LANL	1,059,768	570,602	1,429,085	1,630,370	2,488,853
Los Alamos National Laboratory	VL-LANL-0040-D	Nuclear Facility D&D-LANL (Defense)	92,036	106,143	145,143	198,179	237,179
Los Alamos National Laboratory	VL-LANL-0040-N	Nuclear Facility D&D-LANL (Non-Defense)	13,352	3,937	3,937	17,289	17,289
Los Alamos National Laboratory Total			1,751,364	895,136	1,841,619	2,646,500	3,592,983
Miamisburg	OH-MB-0013	Solid Waste Stabilization and Disposition-Miamisburg	264,692	0	0	264,692	264,692
Miamisburg	OH-MB-0020	Safeguards and Security-Miamisburg	28,284	0	0	28,284	28,284
Miamisburg	OH-MB-0030	Soil and Water Remediation-Miamisburg	252,228	6,610	6,610	258,838	258,838
Miamisburg	OH-MB-0031	Soil and Water Remediation - OU-1	43,000	0	0	43,000	43,000
Miamisburg	OH-MB-0040	Nuclear Facility D&D-Miamisburg	504,677	0	0	504,677	504,677
Miamisburg	OH-MB-0100	Miamisburg Post-Closure Administration	58,956	776,320	776,320	835,276	835,276
Miamisburg	OH-MB-0101	Miamisburg Community and Regulatory Support	9,831	0	0	9,831	9,831
Miamisburg Total			1,161,668	782,930	782,930	1,944,598	1,944,598
Moab	CBC-MOAB-0031	Soil and Water Remediation-Moab	130,029	869,629	909,564	999,658	1,039,593
Moab Total			130,029	869,629	909,564	999,658	1,039,593
Nevada Test Site	VL-NV-0013	Solid Waste Stabilization and Disposition-Nevada Test Site	101,022	0	0	101,022	101,022
Nevada Test Site	VL-NV-0030	Soil and Water Remediation-Nevada Test	757,679	912,308	1,194,036	1,669,987	1,951,715

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
		Site					
Nevada Test Site	VL-NV-0080	Operate Waste Disposal Facility-Nevada	103,569	466,251	490,632	569,820	594,201
Nevada Test Site	VL-NV-0100	Nevada Community and Regulatory Support	47,767	54,800	54,800	102,567	102,567
Nevada Test Site Total			1,010,037	1,433,359	1,739,468	2,443,396	2,749,505
Oak Ridge Reservation	HQ-SW-0013X-OR	Solid Waste Stabilization and Disposition-Science Current Generation	142,978	0	0	142,978	142,978
Oak Ridge Reservation	OR-0011Y	NM Stabilization and Disposition-ETTP Uranium Facilities Management	52,409	0	0	52,409	52,409
Oak Ridge Reservation	OR-0011Z	Downblend of U-233 in Building 3019	138,809	222,040	246,012	360,849	384,821
Oak Ridge Reservation	OR-0013A	Solid Waste Stabilization and Disposition-2006	464,919	0	0	464,919	464,919
Oak Ridge Reservation	OR-0013B	Solid Waste Stabilization and Disposition-2012	1,017,844	658,149	731,464	1,675,993	1,749,308
Oak Ridge Reservation	OR-0020	Safeguards and Security	144,101	138,469	143,930	282,570	288,031
Oak Ridge Reservation	OR-0030	Soil and Water Remediation-Melton Valley	350,609	0	0	350,609	350,609
Oak Ridge Reservation	OR-0031	Soil and Water Remediation-Offsites	60,234	1,758	1,831	61,992	62,065
Oak Ridge Reservation	OR-0040	Nuclear Facility D&D-East Tennessee Technology Park (D&D Fund)	1,991,854	1,077,844	1,210,922	3,069,698	3,202,776
Oak Ridge Reservation	OR-0041	Nuclear Facility D&D-Y-12	356,358	692,680	814,417	1,049,038	1,170,775
Oak Ridge Reservation	OR-0042	Nuclear Facility D&D-Oak Ridge National Laboratory	393,532	805,748	914,208	1,199,280	1,307,740
Oak Ridge Reservation	OR-0043	Nuclear Facility D&D-East Tennessee Technology Park (Defense)	84,987	43,625	45,773	128,612	130,760
Oak Ridge Reservation	OR-0100	Oak Ridge Reservation Community & Regulatory Support (Defense)	98,824	47,189	49,019	146,013	147,843
Oak Ridge Reservation	OR-0101	Oak Ridge Contract/Post-Closure Liabilities/Administration	105,139	0	0	105,139	105,139
Oak Ridge Reservation	OR-0102	East Tennessee Technology Park Contract/Post-Closure Liabilities/Administration	162,831	146,302	151,976	309,133	314,807

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Oak Ridge Reservation	OR-0103	Oak Ridge Reservation Community & Regulatory Support (D&D Fund)	44,375	0	0	44,375	44,375
Oak Ridge Reservation	OR-0900-D	Pre-2004 Completions (Defense)	16,828	0	0	16,828	16,828
Oak Ridge Reservation	OR-0900-N	Pre-2004 Completions (Non-Defense)	617,253	0	0	617,253	617,253
Oak Ridge Reservation Total			6,243,884	3,833,804	4,309,552	10,077,688	10,553,436
Office of River Protection	HQ-HLW-0014X-RV	Radioactive Liquid Tank Waste Stabilization and Disposition-Storage Operations Awaiting Geologic Rep	0	122,239	122,239	122,239	122,239
Office of River Protection	ORP-0014	Radioactive Liquid Tank Waste Stabilization and Disposition	4,443,847	39,672,965	57,575,910	44,116,812	62,019,757
Office of River Protection	ORP-0060	Major Construction-Waste Treatment Plant	5,384,834	6,724,904	6,724,904	12,109,738	12,109,738
Office of River Protection	ORP-0061	pre-Waste Treatment Plan, Transition Activity	433,314	0	0	433,314	433,314
Office of River Protection	ORP-0100	Office of River Protection Community and Regulatory Support	1,458	0	0	1,458	1,458
Office of River Protection Total			10,263,453	46,520,108	64,423,053	56,783,561	74,686,506
Other	CBC-0100-FN	CBC Post Closure Administration - Fernald	53,477	2,635	2,635	56,112	56,112
Other	CBC-0100-MD	CBC Post Closure Administration - Mound	359	3,046	3,046	3,405	3,405
Other	CBC-0100-RF	CBC Post Closure Administration - Rocky Flats	6,137	14,370	14,370	20,507	20,507
Other	CBC-CA-0013B-N	Solid Waste Stabilization and Disposition-California Sites-2012 (Non-Defense)	6,118	357	357	6,475	6,475
Other	CBC-CA-0100-N	Community and Regulatory Support (Non-Defense)	2,594	0	0	2,594	2,594
Other	CH-OPS-0900	Pre-2004 Completions	98,850	0	0	98,850	98,850
Other	CH-PPPL-0030	Soil and Water Remediation-Princeton Site A/B	309	0	0	309	309
Other	NV-0030	Soil and Water Remediation - Offsites	84,993	0	0	84,993	84,993
Other	OH-OPS-0900-D	Pre-2004 Completions	57,659	0	0	57,659	57,659

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Other	OH-OPS-0900-N	Pre-2004 Completions (Non-Defense)	396,924	0	0	396,924	396,924
Other	VL-FAO-0100-D	Nuclear Material Stewardship (Defense)	108,725	0	0	108,725	108,725
Other	VL-FAO-0100-N	Nuclear Material Stewardship (Non-Defense)	14,954	0	0	14,954	14,954
Other	VL-FAO-0101	Miscellaneous Programs and Agreements in Principle	85,877	18,122	18,122	103,999	103,999
Other	VL-FAO-0900	Pre-2004 Completions	232,740	0	0	232,740	232,740
Other	VL-FOO-0013B-D	Solid Waste Stabilization and Disposition Support-Lawrence Livermore National Laboratory	14,200	1,192	1,192	15,392	15,392
Other	VL-FOO-0013B-N	Solid Waste Stabilization and Disposition-Oakland Sites-2012 (Non-Defense)	68	0	0	68	68
Other	VL-FOO-0100-D	LLNL Community and Regulatory Support	5,516	0	0	5,516	5,516
Other	VL-FOO-0100-N	Oakland Community and Regulatory Support (Non-Defense)	79	0	0	79	79
Other	VL-FOO-0900-N	Pre-2004 Completions (Non-Defense)	20,896	0	0	20,896	20,896
Other	VL-GA-0012	SNF Stabilization and Disposition-General Atomics	15,108	0	0	15,108	15,108
Other	VL-SPRU-0040	Nuclear Facility D&D-Separations Process Research Unit	64,876	84,360	87,970	149,236	152,846
Other	VL-SV-0100	South Valley Superfund	6,061	0	0	6,061	6,061
Other Total			1,276,520	124,082	127,692	1,400,602	1,404,212
Paducah Gaseous Diffusion Plant	GDP D&D	Nuclear Facility D&D-Paducah	0	5,800,000	12,500,000	5,800,000	12,500,000
Paducah Gaseous Diffusion Plant	PA-0011	NM Stabilization and Disposition-Paducah Uranium Facilities Management	32,097	27,962	29,417	60,059	61,514
Paducah Gaseous Diffusion Plant	PA-0011X	NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	695,142	1,046,071	1,046,071	1,741,213	1,741,213
Paducah Gaseous Diffusion Plant	PA-0013	Solid Waste Stabilization and Disposition	245,396	85,142	102,428	330,538	347,824
Paducah Gaseous Diffusion Plant	PA-0020	Safeguards and Security	47,973	92,425	105,802	140,398	153,775

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Paducah Gaseous Diffusion Plant	PA-0040	Nuclear Facility D&D-Paducah	801,521	1,267,738	1,349,014	2,069,259	2,150,535
Paducah Gaseous Diffusion Plant	PA-0100	Paducah Community and Regulatory Support (Non-Defense)	10,534	0	0	10,534	10,534
Paducah Gaseous Diffusion Plant	PA-0102	Paducah Contract/Post-Closure Liabilities/Administration (D&D Fund)	33,356	8,888	13,374	42,244	46,730
Paducah Gaseous Diffusion Plant	PA-0103	Paducah Community and Regulatory Support (D&D Fund)	19,195	27,660	30,914	46,855	50,109
Paducah Gaseous Diffusion Plant Total			1,885,214	8,355,886	15,177,020	10,241,100	17,062,234
Pantex Plant	VL-PX-0030	Soil and Water Remediation-Pantex	193,356	0	0	193,356	193,356
Pantex Plant	VL-PX-0040	Nuclear Facility D&D-Pantex	15,120	0	0	15,120	15,120
Pantex Plant Total			208,476	0	0	208,476	208,476
Portsmouth Gaseous Diffusion Plant	PO-0011	NM Stabilization and Disposition-Portsmouth Uranium Facilities Management	100,733	6	131	100,739	100,864
Portsmouth Gaseous Diffusion Plant	PO-0011X	NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	289,172	1,192,792	1,192,792	1,481,964	1,481,964
Portsmouth Gaseous Diffusion Plant	PO-0013	Solid Waste Stabilization and Disposition	439,377	96,658	97,138	536,035	536,515
Portsmouth Gaseous Diffusion Plant	PO-0020	Safeguards and Security	105,775	629,774	629,774	735,549	735,549
Portsmouth Gaseous Diffusion Plant	PO-0040	Nuclear Facility D&D-Portsmouth	842,213	5,001,370	11,894,438	5,843,583	12,736,651
Portsmouth Gaseous Diffusion Plant	PO-0041	Nuclear Facility D&D-Portsmouth GCEP	66,117	0	0	66,117	66,117
Portsmouth Gaseous Diffusion Plant	PO-0101	Portsmouth Cold Standby	372,408	0	0	372,408	372,408
Portsmouth Gaseous Diffusion Plant	PO-0103	Portsmouth Contract/Post-Closure Liabilities/Administration (D&D Fund)	5,366	36,087	36,087	41,453	41,453
Portsmouth Gaseous Diffusion Plant	PO-0104	Portsmouth Community and Regulatory Support (D&D Fund)	2,653	18,053	18,053	20,706	20,706
Portsmouth Gaseous Diffusion Plant Total			2,223,814	6,974,740	13,868,413	9,198,554	16,092,227

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Program Direction	HQ-PD-0100	Program Direction	3,896,389	8,183,679	8,183,679	12,080,068	12,080,068
Program Direction Total			3,896,389	8,183,679	8,183,679	12,080,068	12,080,068
Rocky Flats Environmental Technology Site	CBC-RF-0102	Rocky Flats Future Use	3,061	0	0	3,061	3,061
Rocky Flats Environmental Technology Site	RF-0011	NM Stabilization and Disposition	471,415	0	0	471,415	471,415
Rocky Flats Environmental Technology Site	RF-0013	Solid Waste Stabilization and Disposition	871,899	0	0	871,899	871,899
Rocky Flats Environmental Technology Site	RF-0020	Safeguards and Security	299,404	0	0	299,404	299,404
Rocky Flats Environmental Technology Site	RF-0030	Soil and Water Remediation	2,055,578	0	0	2,055,578	2,055,578
Rocky Flats Environmental Technology Site	RF-0040	Nuclear Facility D&D-North Side Facility Closures	1,909,146	0	0	1,909,146	1,909,146
Rocky Flats Environmental Technology Site	RF-0041	Nuclear Facility D&D-South Side Facility Closures	748,973	0	0	748,973	748,973
Rocky Flats Environmental Technology Site	RF-0100	Rocky Flats Environmental Technology Site Contract Liabilities	100,008	2,550,959	2,550,959	2,650,967	2,650,967
Rocky Flats Environmental Technology Site	RF-0101	Rocky Flats Community and Regulatory Support	37,023	0	0	37,023	37,023
Rocky Flats Environmental Technology Site Total			6,496,507	2,550,959	2,550,959	9,047,466	9,047,466
Sandia National Laboratory	VL-SN-0030	Soil and Water Remediation-Sandia	235,249	0	0	235,249	235,249

Lifecycle Costs by Program Baseline Summary (PBS)
Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Sandia National Laboratory Total			235,249	0	0	235,249	235,249
Savannah River Site	HQ-SNF-0012X-SR	SNF Stabilization and Disposition-Storage Operations Awaiting Geologic Repository	68,140	0	0	68,140	68,140
Savannah River Site	SR-0011A	NM Stabilization and Disposition-2006	134,009	0	0	134,009	134,009
Savannah River Site	SR-0011B	NM Stabilization and Disposition-2012	3,663,031	92,675	92,675	3,755,706	3,755,706
Savannah River Site	SR-0011C	NM Stabilization and Disposition-2035	1,316,140	6,036,912	6,666,915	7,353,052	7,983,055
Savannah River Site	SR-0012	SNF Stabilization and Dispostion	315,804	733,365	755,365	1,049,169	1,071,169
Savannah River Site	SR-0013	Solid Waste Stabilization and Disposition	1,111,294	3,170,007	3,611,716	4,281,301	4,723,010
Savannah River Site	SR-0014C	Radioactive Liquid Tank Waste Stabilization and Disposition-2035	6,328,164	16,007,555	24,499,555	22,335,719	30,827,719
Savannah River Site	SR-0014C-T	Radioactive Liquid Tank Waste Stabilization and Disposition-2035 (T)	137,603	0	0	137,603	137,603
Savannah River Site	SR-0020	Safeguards and Security	1,326,240	2,287,265	2,287,265	3,613,505	3,613,505
Savannah River Site	SR-0030	Area Completion	1,186,052	2,850,833	3,337,833	4,036,885	4,523,885
Savannah River Site	SR-0040	Nuclear Facility D&D	490,106	5,148,883	5,909,877	5,638,989	6,399,983
Savannah River Site	SR-0040B	Nuclear Facility D&D-2012	778	0	0	778	778
Savannah River Site	SR-0100	Non-Closure Mission Support	199,954	145,000	145,000	344,954	344,954
Savannah River Site	SR-0101	Savannah River Community and Regulatory Support	120,375	217,500	217,500	337,875	337,875
Savannah River Site	SR-0900	Pre-2004 Completions	198,242	0	0	198,242	198,242
Savannah River Site Total			16,595,932	36,689,995	47,523,701	53,285,927	64,119,633
Stanford Linear Accelerator Center	CBC-SLAC-0030	Soil and Water Remediation-Stanford Linear Accelerator Center	37,679	13,858	16,326	51,537	54,005
Stanford Linear Accelerator Center Total			37,679	13,858	16,326	51,537	54,005
Technology Development and Deployment	HQ-TD-0100	Technology Development	1,683,888	1,388,695	1,388,695	3,072,583	3,072,583

Lifecycle Costs by Program Baseline Summary (PBS)

Thousands of Dollars

Site	PBS Field Code	PBS Name	Prior Costs FY 97-2009	FY10 and Remaining Cost (Low Range)	FY10 and Remaining Cost (High Range)	Lifecycle Cost (Low Range)	Lifecycle Cost (High Range)
Technology Development and Deployment Total			1,683,888	1,388,695	1,388,695	3,072,583	3,072,583
Waste Isolation Pilot Plant	CB-0020	Safeguards and Security	26,554	164,967	164,967	191,521	191,521
Waste Isolation Pilot Plant	CB-0080	Operate Waste Disposal Facility-WIPP	1,969,567	2,947,982	3,370,495	4,917,549	5,340,062
Waste Isolation Pilot Plant	CB-0081	Central Characterization Project	162,708	337,790	402,357	500,498	565,065
Waste Isolation Pilot Plant	CB-0090	Transportation-WIPP	336,984	606,668	681,339	943,652	1,018,323
Waste Isolation Pilot Plant	CB-0100	US/Mexico/Border/Material Partnership Initiative	11,329	0	0	11,329	11,329
Waste Isolation Pilot Plant	CB-0101	Economic Assistance to the State of New Mexico	203,270	56,682	56,682	259,952	259,952
Waste Isolation Pilot Plant	CB-0900	Pre-2004 Completions	7,137	0	0	7,137	7,137
Waste Isolation Pilot Plant Total			2,717,549	4,114,089	4,675,840	6,831,638	7,393,389
West Valley Demonstration Project	OH-WV-0012	SNF Stabilization and Disposition-West Valley	32,319	0	0	32,319	32,319
West Valley Demonstration Project	OH-WV-0013	Nuclear Facility D&D West Valley	263,856	85,014	99,214	348,870	363,070
West Valley Demonstration Project	OH-WV-0014	Radioactive Liquid Tank Waste Stabilization and Disposition-West Valley High-Level Waste Storage	0	366,000	407,000	366,000	407,000
West Valley Demonstration Project	OH-WV-0020	Safeguards and Security-West Valley	16,695	29,077	29,077	45,772	45,772
West Valley Demonstration Project	OH-WV-0040	Nuclear Facility D&D-West Valley	513,459	542,396	625,796	1,055,855	1,139,255
West Valley Demonstration Project Total			826,329	1,022,487	1,161,087	1,848,816	1,987,416
Grand Total			81,734,476	192,834,483	247,239,497	274,568,959	328,973,973

Corporate Performance Measure Quantities by Program Baseline Summary[abc]

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Closure Sites								
Ashtabula	OH-AB-0030	Soil and Water Remediation-Ashtabula						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	3,707	3,707	3,707	3,707	0	3,707
		Radioactive Facility Completions (Number of Facilities)	28	28	28	28	0	28
		Industrial Facility Completions (Number of Facilities)	7	7	7	7	0	7
		Remediation Complete (Number of Release Sites)	3	3	3	3	0	3
Columbus	OH-CL-0040	Nuclear Facility D&D-West Jefferson						
		Nuclear Facility Completions (Number of Facilities)	1	1	1	1	0	1
		Radioactive Facility Completions (Number of Facilities)	14	14	14	14	0	14
		Remediation Complete (Number of Release Sites)	2	2	2	2	0	2
Fernald	OH-FN-0013	Solid Waste Stabilization and Disposition-Fernald						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	7,085	7,085	7,085	7,085	0	7,085
		Remediation Complete (Number of Release Sites)	4	4	4	4	0	4
Fernald	OH-FN-0030	Soil and Water Remediation-Fernald						

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[a] Life-cycle estimates for release sites, facilities, and high-level waste canisters include pre-1997 actuals. Quantities for all other measures except low-level and mixed low-level waste disposal begin in 1997. Low-level and mixed low-level waste disposal begins in 1998.

[b] This chart provides a consistent set of performance measures for the EM program by PBS. The project-level justification provides a description of significant activities for each project including performance measures and project-specific budget milestones, as applicable.

[c] FY 2003 – FY 2005 annual results and targets, as well as life-cycle numbers, are under configuration control. In enforcing the Assistant Secretary's added emphasis on project management principles, EM's Configuration Control Board maintains strict configuration control of these numbers to ensure performance and accountability is firmly established and reported.

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Remediation Complete (Number of Release Sites)	2	2	2	2	0	2
Fernald	OH-FN-0050	Non-Nuclear Facility D&D-Fernald						
		Radioactive Facility Completions (Number of Facilities)	29	29	29	29	0	29
		Industrial Facility Completions (Number of Facilities)	1	1	1	1	0	1
Miamisburg	OH-MB-0013	Solid Waste Stabilization and Disposition-Miamisburg						
		Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	0	0	0
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	3,947	3,947	3,947	3,947	0	3,947
Miamisburg	OH-MB-0030	Soil and Water Remediation-Miamisburg						
		Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	0	0	0
		Remediation Complete (Number of Release Sites)	178	178	178	178	0	178
Miamisburg	OH-MB-0040	Nuclear Facility D&D-Miamisburg						
		Nuclear Facility Completions (Number of Facilities)	8	8	8	8	0	8
		Radioactive Facility Completions (Number of Facilities)	11	11	11	11	0	11
		Industrial Facility Completions (Number of Facilities)	116	116	116	116	0	116
Rocky Flats Environmental Technology Site	RF-0011	NM Stabilization and Disposition						
		Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	1,895	1,895	1,895	1,895	0	1,895
		Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	103,901	103,901	103,901	103,901	0	103,901
Rocky Flats Environmental Technology Site	RF-0013	Solid Waste Stabilization and Disposition						
		Transuranic Waste shipped for disposal	15,036	15,036	15,036	15,036	0	15,036

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		(Cubic meters) - CH						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	602,188	602,188	602,188	602,188	0	602,188
Rocky Flats Environmental Technology Site	RF-0030	Soil and Water Remediation						
		Remediation Complete (Number of Release Sites)	360	360	360	360	0	360
Rocky Flats Environmental Technology Site	RF-0040	Nuclear Facility D&D-North Side Facility Closures						
		Material Access Areas eliminated (Number of Material Access Areas)	6	6	6	6	0	6
		Nuclear Facility Completions (Number of Facilities)	6	6	6	6	0	6
		Radioactive Facility Completions (Number of Facilities)	22	22	22	22	0	22
		Industrial Facility Completions (Number of Facilities)	141	141	141	141	0	141
Rocky Flats Environmental Technology Site	RF-0041	Nuclear Facility D&D-South Side Facility Closures						
		Material Access Areas eliminated (Number of Material Access Areas)	1	1	1	1	0	1
		Radioactive Facility Completions (Number of Facilities)	32	32	32	32	0	32
		Industrial Facility Completions (Number of Facilities)	176	176	176	176	0	176
All Other Sites								
Brookhaven National Laboratory	BRNL-0030	Soil and Water Remediation-Brookhaven National Laboratory						
		Radioactive Facility Completions (Number of Facilities)	3	3	3	3	0	3
		Remediation Complete (Number of Release Sites)	75	75	75	75	0	75
Brookhaven National	BRNL-0040	Nuclear Facility D&D-Brookhaven						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Laboratory		Graphite Research Reactor						
		Nuclear Facility Completions (Number of Facilities)	0	0	1	1	0	1
		Radioactive Facility Completions (Number of Facilities)	7	7	8	8	0	8
		Remediation Complete (Number of Release Sites)	1	1	1	1	0	1
Brookhaven National Laboratory	BRNL-0041	Nuclear Facility D&D-High Flux Beam Reactor						
		Remediation Complete (Number of Release Sites)	1	1	1	1	0	1
California Site Support	CBC-CA-0013B-N	Solid Waste Stabilization and Disposition-Oakland Sites-2012 (Non-Defense)						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	83	83	83	83	0	83
Energy Technology Engineering Center	CBC-ETEC-0040	Nuclear Facility D&D-Energy Technology Engineering Center						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,055	1,055	1,055	1,055	25	1,080
		Radioactive Facility Completions (Number of Facilities)	4	4	4	4	2	6
		Industrial Facility Completions (Number of Facilities)	24	24	24	24	2	26
		Remediation Complete (Number of Release Sites)	4	4	4	4	10	14
Inhalation Toxicology Laboratory	CBC-ITL-0030	Soil and Water Remediation-Inhalation Toxicology Laboratory						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	359	359	359	359	0	359
		Remediation Complete (Number of Release Sites)	9	9	9	9	0	9
Lawrence Berkeley National Laboratory	CBC-LBNL-0030	Soil and Water Remediation-Lawrence Berkeley National Laboratory						
		Remediation Complete (Number of Release Sites)	181	181	181	181	0	181
Stanford Linear	CBC-SLAC-	Soil and Water Remediation-Stanford						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Accelerator Center	0030	Linear Accelerator Center						
		Remediation Complete (Number of Release Sites)	17	17	32	51	0	51
Argonne National Laboratory-East	CH-ANLE-0030	Soil and Water Remediation-Argonne National Laboratory-East						
		Remediation Complete (Number of Release Sites)	443	443	443	443	0	443
Argonne National Laboratory-East	CH-ANLE-0040	Nuclear Facility D&D-Argonne National Laboratory-East						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	30	30
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	22	22
		Radioactive Facility Completions (Number of Facilities)	69	78	78	78	2	80
Chicago Operations Office	CH-OPS-0900	Pre-2004 Completions						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	537	537	537	537	0	537
		Remediation Complete (Number of Release Sites)	30	30	30	30	0	30
Laboratory for Energy-Related Health Research	LEHR-0040	Nuclear Facility D&D-Laboratory for Energy-Related Health Research						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	944	944	944	944	0	944
		Industrial Facility Completions (Number of Facilities)	1	1	1	1	0	1
		Remediation Complete (Number of Release Sites)	16	16	16	16	0	16
California Site Support	VL-FOO-0900-N	Pre-2004 Completions (Non-Defense)						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	189	189	189	189	0	189
		Remediation Complete (Number of Release Sites)	3	3	3	3	0	3
General Atomics	VL-GA-0012	SNF Stabilization and Disposition-General Atomics						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	1	1	1	1	0	1
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,716	1,716	1,716	1,716	0	1,716
		Remediation Complete (Number of Release Sites)	2	2	2	2	0	2
Idaho								
Argonne National Laboratory - West	CH-ANLW-0030	Soil and Water Remediation-Argonne National Laboratory-West						
		Remediation Complete (Number of Release Sites)	37	37	37	37	0	37
Idaho National Laboratory	ID-0011	NM Stabilization and Disposition						
		Enriched Uranium packaged for disposition (Number of Containers)	1,586	1,586	1,586	1,586	0	1,586
		Material Access Areas eliminated (Number of Material Access Areas)	1	1	1	1	0	1
Idaho National Laboratory	ID-0012C	SNF Stabilization and Disposition-2035						
		Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	0	0	0	0	253	253
Idaho National Laboratory	ID-0013	Solid Waste Stabilization and Disposition						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	26,492	33,795	39,495	45,195	21,505	66,700
		Transuranic Waste shipped for disposal (Cubic meters) - RH	72	92	92	92	25	117
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	66,599	67,688	69,518	71,568	6,385	77,953
Idaho National Laboratory	ID-0014B	Radioactive Liquid Tank Waste Stabilization and Disposition-2012						
		Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	100	800	900
		Liquid Waste Tanks closed (Number of Tanks)	7	7	7	7	4	11
Idaho National	ID-0014C	Radioactive Liquid Tank Waste						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Laboratory		Stabilization and Disposition-2035						
		High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	0	6,660	6,660
Idaho National Laboratory	ID-0030B	Soil and Water Remediation-2012						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	306	1,628	1,628	1,628	7,429	9,057
		Remediation Complete (Number of Release Sites)	240	250	329	333	10	343
Idaho National Laboratory	ID-0030C	Soil and Water Remediation-2035						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	7,398	7,398
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	0	0	0	0	31,161	31,161
		Remediation Complete (Number of Release Sites)	0	0	0	0	23	23
Idaho National Laboratory	ID-0040B	Nuclear Facility D&D-2012						
		Nuclear Facility Completions (Number of Facilities)	24	28	28	28	31	59
		Radioactive Facility Completions (Number of Facilities)	0	0	0	0	23	23
		Industrial Facility Completions (Number of Facilities)	0	0	0	0	35	35
Idaho National Laboratory	ID-0040C	Nuclear Facility D&D-2035						
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	33	33
		Radioactive Facility Completions (Number of Facilities)	0	0	0	0	10	10
		Industrial Facility Completions (Number of Facilities)	0	0	0	0	77	77
Idaho National Laboratory	ID-0050B	Non-Nuclear Facility D&D-2012						
		Radioactive Facility Completions	32	35	35	35	0	35

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		(Number of Facilities)						
		Industrial Facility Completions (Number of Facilities)	138	143	143	143	0	143
Idaho Operations Office	ID-0900	Pre-2004 Completions (Defense)						
		Remediation Complete (Number of Release Sites)	233	233	233	233	0	233
Oak Ridge								
East Tennessee Technology Park	OR-0011Z							
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	0	96	96	96	1,330	1,426
Oak Ridge National Laboratory Y-12 Plant	HQ-SW-0013X HQ-SW-0013Y							
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	16,252	16,252	16,252	16,252	0	16,252
East Tennessee Technology Park	OR-0011Y	NM Stabilization and Disposition-ETTP Uranium Facilities Management						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	93	93	93	93	0	93
		Nuclear Facility Completions (Number of Facilities)	4	4	4	4	0	4
Oak Ridge Reservation	OR-0013A	Solid Waste Stabilization and Disposition-2006						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	48,584	48,584	48,584	48,584	0	48,584
Oak Ridge Reservation	OR-0013B	Solid Waste Stabilization and Disposition-2012						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	16	81	81	81	1,368	1,449
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	5	5	5	545	550
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	11,925	12,921	13,607	15,897	13,717	29,614
Oak Ridge Reservation	OR-0030	Soil and Water Remediation-Melton Valley						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Nuclear Facility Completions (Number of Facilities)	2	2	2	2	0	2
		Radioactive Facility Completions (Number of Facilities)	15	15	15	15	0	15
		Industrial Facility Completions (Number of Facilities)	2	2	2	2	0	2
		Remediation Complete (Number of Release Sites)	106	106	106	106	0	106
Oak Ridge Reservation	OR-0031	Soil and Water Remediation-Offsites						
		Remediation Complete (Number of Release Sites)	6	7	8	8	0	8
East Tennessee Technology Park	OR-0040	Nuclear Facility D&D-East Tennessee Technology Park (D&D Fund)						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	5,178	5,178	5,178	5,178	0	5,178
		Nuclear Facility Completions (Number of Facilities)	2	2	2	2	2	4
		Radioactive Facility Completions (Number of Facilities)	8	8	10	10	20	30
		Industrial Facility Completions (Number of Facilities)	282	310	331	348	210	558
		Remediation Complete (Number of Release Sites)	91	103	122	123	44	167
Y-12 Plant	OR-0041	Nuclear Facility D&D-Y-12						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	0	0	0	0	43,038	43,038
		Industrial Facility Completions (Number of Facilities)	1	1	1	1	6	7
		Remediation Complete (Number of Release Sites)	28	28	28	28	110	138
Oak Ridge National Laboratory	OR-0042	Nuclear Facility D&D-Oak Ridge National Laboratory						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	24	24
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	198	198

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	366	811	1,160	1,487	3,031	4,518
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	15	15
		Radioactive Facility Completions (Number of Facilities)	3	3	3	3	28	31
		Industrial Facility Completions (Number of Facilities)	7	7	7	7	21	28
		Remediation Complete (Number of Release Sites)	80	80	80	80	97	177
East Tennessee Technology Park	OR-0043	Nuclear Facility D&D-East Tennessee Technology Park (Defense)						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	32,979	32,979	32,979	32,979	0	32,979
		Industrial Facility Completions (Number of Facilities)	6	6	7	7	30	37
Oak Ridge Operations Office	OR-0900-D	Pre-2004 Completions (Defense)						
		Remediation Complete (Number of Release Sites)	28	28	74	74	0	74
Oak Ridge Operations Office	OR-0900-N	Pre-2004 Completions (Non-Defense)						
		Industrial Facility Completions (Number of Facilities)	3	3	3	3	0	3
		Remediation Complete (Number of Release Sites)	56	56	23	23	0	23
Paducah								
Paducah Gaseous Diffusion Plant	PA-0011	NM Stabilization and Disposition-Paducah Uranium Facilities Management						
		Enriched Uranium packaged for disposition (Number of Containers)	0	0	0	0	182	182
Paducah Gaseous Diffusion Plant	PA-0011X	NM Stabilization and Disposition-Depleted Uranium Hexaflouride Conversion						
		Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	7,750	450,000	457,750

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Paducab Gaseous Diffusion Plant	PA-0013	Solid Waste Stabilization and Disposition						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	15,642	19,150	19,896	20,642	5,966	26,608
Paducah Gaseous Diffusion Plant	PA-0040	Nuclear Facility D&D-Paducah						
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	19	19
		Radioactive Facility Completions (Number of Facilities)	2	2	2	3	19	22
		Industrial Facility Completions (Number of Facilities)	12	17	17	19	153	172
		Remediation Complete (Number of Release Sites)	93	93	108	124	92	216
Paducah Gaseous Diffusion Plant	PA-0900	Pre-2004 Completions						
		Remediation Complete (Number of Release Sites)	1	1	1	1	0	1
Portsmouth								
Portsmouth Gaseous Diffusion Plant	PO-0011X	NM Stabilization and Disposition-Depleted Uranium Hexaflouride Conversion						
		Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	9,800	243,000	252,800
Portsmouth Gaseous Diffusion Plant	PO-0013	Solid Waste Stabilization and Disposition						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	31,907	35,754	35,754	35,754	0	35,754
Portsmouth Gaseous Diffusion Plant	PO-0040	Nuclear Facility D&D-Portsmouth						
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	13	13
		Radioactive Facility Completions (Number of Facilities)	7	7	7	7	20	27
		Industrial Facility Completions (Number of Facilities)	7	8	8	8	113	121

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Remediation Complete (Number of Release Sites)	20	20	20	20	1	21
Portsmouth Gaseous Diffusion Plant	PO-0900	Pre-2004 Completions						
		Remediation Complete (Number of Release Sites)	130	130	130	130	0	130
Richland								
Hanford Site	RL-0011	NM Stabilization and Disposition-PFP						
		Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	2,275	2,275	2,275	2,275	0	2,275
		Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	3,437	3,437	3,437	3,437	0	3,437
		Material Access Areas eliminated (Number of Material Access Areas)	1	16	20	20	0	20
		Nuclear Facility Completions (Number of Facilities)	21	21	21	23	8	31
		Radioactive Facility Completions (Number of Facilities)	0	0	0	1	25	26
Hanford Site	RL-0012	SNF Stabilization and Disposition						
		Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	2,117	2,117	2,117	2,117	0	2,117
Hanford Site	RL-0013C	Solid Waste Stabilization and Disposition-200 Area						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	3,030	3,030	3,030	3,030	21,550	24,580
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	858	858
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	47,213	48,572	48,572	48,572	2,878	51,450
Hanford Site	RL-0040	Nuclear Facility D&D-Remainder of Hanford						
		Nuclear Facility Completions (Number of Facilities)	4	4	4	4	35	39
		Radioactive Facility Completions (Number of Facilities)	12	12	12	12	168	180
		Industrial Facility Completions (Number	223	232	232	232	417	649

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		of Facilities)						
		Remediation Complete (Number of Release Sites)	39	39	39	39	818	857
Hanford Site	RL-0041	Nuclear Facility D&D-River Corridor Closure Project						
		Enriched Uranium packaged for disposition (Number of Containers)	2,958	2,958	2,958	2,958	0	2,958
		Depleted and Other Uranium packaged for disposition (Metric Tons)	3,100	3,100	3,100	3,100	0	3,100
		Nuclear Facility Completions (Number of Facilities)	3	3	7	7	1	8
		Radioactive Facility Completions (Number of Facilities)	37	40	43	59	72	131
		Industrial Facility Completions (Number of Facilities)	113	144	156	199	190	389
		Remediation Complete (Number of Release Sites)	429	440	459	519	326	845
Hanford Site	RL-0042	Nuclear Facility D&D-Fast Flux Test Facility Project						
		Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	7	7	7	7	0	7
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	4	4
		Radioactive Facility Completions (Number of Facilities)	0	0	0	0	9	9
		Industrial Facility Completions (Number of Facilities)	0	0	0	0	31	31
River Protection								
River Protection	ORP-0014	Radioactive Liquid Tank Waste Stabilization and Disposition						
		Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	0	54,000	54,000
		Liquid Waste Tanks closed (Number of Tanks)	0	0	0	0	177	177
		High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	0	9,667	9,667

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	1,555	1,555
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	3,864	3,864
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	7,952	10,267	12,137	13,653	184,179	197,832
		Nuclear Facility Completions (Number of Facilities)	0	0	0	0	18	18
		Radioactive Facility Completions (Number of Facilities)	0	0	0	0	114	114
		Industrial Facility Completions (Number of Facilities)	0	0	0	0	128	128
		Remediation Complete (Number of Release Sites)	5	5	5	5	273	278
River Protection	ORP-0060	Major Construction-Waste Treatment Plant						
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	546	546
Savannah River								
Savannah River Site	SR-0040							
		Nuclear Facility Completions (Number of Facilities)	11	11	11	11	180	191
		Radioactive Facility Completions (Number of Facilities)	8	8	8	8	32	40
		Industrial Facility Completions (Number of Facilities)	232	232	232	232	527	759
Savannah River Site	SR-0011B	NM Stabilization and Disposition-2012						
		Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	919	919	919	919	0	919
		Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	490	490	490	490	0	490
Savannah River Site	SR-0011C	NM Stabilization and Disposition-2035						
		Enriched Uranium packaged for disposition (Number of Containers)	3,004	3,085	3,184	3,184	0	3,184
		Depleted and Other Uranium packaged for disposition (Metric Tons)	9,974	11,536	11,536	11,536	11,646	23,182

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Savannah River Site	SR-0012	SNF Stabilization and Disposition						
		Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	3	3	3	3	37	40
Savannah River Site	SR-0013	Solid Waste Stabilization and Disposition						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	5,691	6,165	6,165	6,165	9,425	15,590
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	17	17	17	51	68
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	100,620	105,564	105,564	105,564	32,015	137,579
Savannah River Site	SR-0014C	Radioactive Liquid Tank Waste Stabilization and Disposition-2035						
		Liquid Waste in Inventory eliminated (Thousands of Gallons)	1,174	2,110	2,810	3,510	29,590	33,100
		Liquid Waste Tanks closed (Number of Tanks)	2	2	2	4	47	51
		High-Level Waste packaged for final disposition (Number of Containers)	2,599	2,795	2,981	3,278	3,022	6,300
Savannah River Site	SR-0020	Safeguards and Security						
		Material Access Areas eliminated (Number of Material Access Areas)	2	2	2	2	1	3
Savannah River Site	SR-0030	Soil and Water Remediation						
		Remediation Complete (Number of Release Sites)	361	369	369	369	146	515
NNSA Sites								
Offsites	NV-0030	Soil and Water Remediation-Nevada Test Site and Offsites						
		Remediation Complete (Number of Release Sites)	53	53	53	53	0	53
New Mexico Site Support	VL-FAO-0900	Pre-2004 Completions						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,319	1,319	1,319	1,319	0	1,319
		Remediation Complete (Number of Release Sites)	155	155	155	155	0	155
Kansas City Plant	VL-KCP-0030	Soil and Water Remediation-Kansas City						

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
		Plant						
		Remediation Complete (Number of Release Sites)	43	43	43	43	0	43
Los Alamos National Laboratory	VL-LANL-0013	Solid Waste Stabilization and Disposition-LANL Legacy						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	2,095	2,350	3,309	6,472	6,394	12,866
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	16	16	16	78	94
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	567	1,882	2,107	3,384	1,437	4,821
Los Alamos National Laboratory	VL-LANL-0030	Soil and Water Remediation-LANL						
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	5,426	5,426	5,426	5,426	0	5,426
		Remediation Complete (Number of Release Sites)	1,417	1,426	1,456	1,548	541	2,089
Los Alamos National Laboratory	VL-LANL-0040-D	Nuclear Facility D&D-LANL (Defense)						
		Radioactive Facility Completions (Number of Facilities)	0	0	0	0	99	99
Los Alamos National Laboratory	VL-LANL-0040-N	Nuclear Facility D&D-LANL (Non-Defense)						
		Radioactive Facility Completions (Number of Facilities)	0	0	0	1	5	6
Lawrence Livermore National Laboratory	VL-LLNL-0013	Solid Waste Stabilization and Disposition-Lawrence Livermore National Laboratory						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	125	125	125	125	0	125
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	2,766	2,766	2,766	2,766	0	2,766
Lawrence Livermore National Laboratory	VL-LLNL-0030	Soil and Water Remediation-Lawrence Livermore National Laboratory - Main Site						
		Remediation Complete (Number of Release Sites)	120	120	120	120	0	120

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Lawrence Livermore National Laboratory	VL-LLNL-0031	Soil and Water Remediation-Lawrence Livermore National Laboratory - Site 300						
		Remediation Complete (Number of Release Sites)	74	74	74	74	0	74
Nevada Test Site	VL-NV-0013	Solid Waste Stabilization and Disposition-Nevada Test Site						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	449	1,246	1,246	1,246	0	1,246
Nevada Test Site	VL-NV-0030	Soil and Water Remediation-Nevada Test Site						
		Remediation Complete (Number of Release Sites)	1,016	1,060	1,061	1,064	972	2,036
Pantex Plant	VL-PX-0030	Soil and Water Remediation-Pantex						
		Remediation Complete (Number of Release Sites)	237	237	237	237	0	237
Pantex Plant	VL-PX-0040	Nuclear Facility D&D-Pantex						
		Industrial Facility Completions (Number of Facilities)	4	4	4	4	0	4
Sandia National Laboratory	VL-SN-0030	Soil and Water Remediation-Sandia						
		Radioactive Facility Completions (Number of Facilities)	1	1	1	1	0	1
		Remediation Complete (Number of Release Sites)	263	263	264	264	0	264
NNSA Service Center	VL-SPRU-0040	Nuclear Facility D&D-Separations Process Research Unit						
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	50	0	50
		Nuclear Facility Completions (Number of Facilities)	0	0	0	1	3	4
		Remediation Complete (Number of Release Sites)	0	0	4	5	1	6
Nevada Test Site	VL-SV-0100	South Valley Superfund						
		Remediation Complete (Number of Release Sites)	1	1	1	1	0	1

West Valley

Office / Installation	Project Number	Project Name / Measure	Complete Through 2008	Complete Through 2009	Targeted Completion Through 2010	Targeted Completion Through 2011	Balance Remaining	Life-Cycle Quantity
Demonstration Project								
West Valley Demonstration Project	OH-WV-0013	Solid Waste Stabilization and Disposition-West Valley						
		Liquid Waste in Inventory eliminated (Thousands of Gallons)	814	814	814	814	0	814
		High-Level Waste packaged for final disposition (Number of Containers)	275	275	275	275	0	275
		Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	571	571	1,142
		Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	277	278	555
		Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	26,931	27,986	27,986	29,899	0	29,899
West Valley Demonstration Project	OH-WV-0040	Nuclear Facility D&D-West Valley						
		Nuclear Facility Completions (Number of Facilities)	3	3	4	12	2	14
		Radioactive Facility Completions (Number of Facilities)	4	4	4	6	7	13
		Industrial Facility Completions (Number of Facilities)	13	13	14	29	0	29

Carlsbad

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Carlsbad Field Office	26,909	0	27,854	28,771
Waste Isolation Pilot Plant	204,752	172,375	202,483	191,474
Total, Carlsbad	231,661	172,375	230,337	220,245

Site Overview

The Carlsbad Field Office, located in Carlsbad, New Mexico, has the responsibility for management of the National Transuranic Waste Program and the Waste Isolation Pilot Plant, the Nation's only mined geologic repository for the permanent disposal of defense-generated transuranic waste. The waste disposal area is 2,150 feet (almost one-half mile) below the surface located in 200-million year old stable salt beds. The transuranic waste that is eligible for disposal at the Waste Isolation Pilot Plant must ultimately be transported from all the generator sites to this repository for receipt, handling, and disposal.

American Recovery and Reinvestment Act Planned Activities

The Carlsbad Field Office American Recovery and Reinvestment Act (ARRA) activities are funded at $172,375,000. Specifically, this funding will support transuranic waste disposal and facility/equipment modifications, waste characterization, and waste transportation for both contact-handled and remote-handled transuranic waste from around the country to the Waste Isolation Pilot Plant for permanent disposal. The Carlsbad Field Office will accelerate legacy transuranic waste characterization and shipment preparation as well as increase transuranic shipments to the Waste Isolation Pilot Plant repository from five large quantity sites (Hanford, Idaho National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and Savannah River Site) and several small quantity sites including, Lawrence Livermore National Laboratory (California); Argonne National Laboratory (Illinois); Nevada Test Site (Nevada); and Sandia National Laboratories (New Mexico).

Site Description

The Waste Isolation Pilot Plant is the world's first permitted deep geologic repository for the permanent disposal of radioactive waste. It is located in Eddy County in southeastern New Mexico, 26 miles southeast of Carlsbad. The Waste Isolation Pilot Plant's total land area consists of 10,240 acres (16 square miles) with the fenced surface portion of the active site being about 35 acres in size. It is located in an area of low population density, and the area surrounding the facility is used primarily for grazing and development of potash, oil, salt, and natural gas resources.

Site Cleanup Strategy/Scope of Cleanup

The Waste Isolation Pilot Plant is an operating facility, supporting the disposal of transuranic waste from waste generator and storage sites. It is not a cleanup site.

Site Completion (End State)

EM's end state for the Waste Isolation Pilot Plant is the cessation of disposal activities for legacy and newly generated transuranic waste from the DOE complex. The life-cycle planning estimate range is 2035 to 2039 for decommissioning of the surface facilities and permanent closure of the underground. This range is subject to change based on changes to DOE site cleanup schedules and transuranic waste inventories.

Regulatory Framework

The Waste Isolation Pilot Plant has four primary regulators: 1) the Environmental Protection Agency, which regulates the radioactive constituents of waste and repository certification; 2) the New Mexico Environment Department, which regulates the hazardous constituents of waste; 3) the Nuclear Regulatory Commission, which certifies Type B shipping containers; and 4) the Department of Transportation, which regulates highway transportation and Type A payload containers.

In the Waste Isolation Pilot Plant Land Withdrawal Act of 1992, as amended, (Public Law 102-579), Congress established regulatory conditions and standards covering limits on the types and quantities of waste that DOE could place in the repository. The Waste Isolation Pilot Plant operates under a Resource Conservation and Recovery Act, Part B, Hazardous Waste Facility Permit issued by the New Mexico Environment Department in October 1999. The Environmental Protection Agency regulates the Waste Isolation Pilot Plant under specific criteria established in 40 Code of Federal Regulations 194 that require DOE to demonstrate that the Waste Isolation Pilot Plant would meet containment standards. The Environmental Protection Agency initially certified the Waste Isolation Pilot Plant's compliance with these regulations on May 18, 1998. The Department submitted its second Compliance Recertification Application to the Environmental Protection Agency in March 2009.

Agreements with States at the Waste Isolation Pilot Plant's generator sites may impact the Waste Isolation Pilot Plant. For instance, the *Idaho Settlement Agreement* contains transuranic waste shipment milestones for the Idaho National Laboratory.

Critical Project Uncertainties and Assumptions

The ability of generator sites to supply sufficient certifiable waste to support the full utilization of the Waste Isolation Pilot Plant (for emplacement of both remote-handled and contact-handled transuranic waste) is a concern. To address this issue, the DOE Headquarters Office of Environmental Management is working with the generator sites to modify their current site contracts and to improve incentives for transuranic waste retrieval and remediation to increase transuranic waste certification. Through the use of Recovery Act and base program funds, the Carlsbad Field Office is taking action to assist sites' efforts to build a backlog of certified waste to increase waste characterization, shipment, and disposal efficiencies.

Interdependencies

The Waste Isolation Pilot Plant is dependent on the waste generator/storage sites to provide waste for certification, shipment, and disposal. The Waste Isolation Pilot Plant is also dependent on its regulators and their decisions that impact operations, certification of the Waste Isolation Pilot Plant, permit modifications, licenses, shipping, and transportation.

Contract Synopsis

The Carlsbad Field Office currently has four major contracts in place: 1) the Management and Operating Contract for the Waste Isolation Pilot Plant, extended through September 2012 (specific performance incentives were included in the negotiated extension); 2) a technical assistance contract for implementing the independent DOE quality assurance program for the National Transuranic Waste Program through August 2010, awarded on August 11, 2005; 3) a transportation carrier contract, awarded on March 16, 2007; and 4) another carrier contract, awarded on September 27, 2007.

Cleanup Benefits

The Waste Isolation Pilot Plant is crucial to DOE completing its cleanup/closure mission for transuranic waste. It is the only authorized disposal site for transuranic defense waste. The Waste Isolation Pilot Plant is an essential element in reducing the risks to public health, workers, and the environment.

Direct maintenance and repair at the Carlsbad Field Office is estimated to be $14,465,000.

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Waste Isolation Pilot Plant			
CB-0080 / Operate Waste Disposal Facility-WIPP	138,389	154,902	134,999
CB-0081 / Central Characterization Project	34,255	13,730	25,797
CB-0090 / Transportation-WIPP	32,108	33,851	30,678
CB-0101 / Economic Assistance to the State of New Mexico	26,909	27,854	28,771
Subtotal, Waste Isolation Pilot Plant	231,661	230,337	220,245

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Carlsbad					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
CB-0080 / Operate Waste Disposal Facility-WIPP	**138,389**	**154,902**	**134,999**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project supports activities related to the disposal of contact-handled and remote-handled transuranic waste at the Waste Isolation Pilot Plant. Key elements of this system are: 1) operation of the disposal facility—including mining, waste handling, and the infrastructure to safely maintain the facility and operations in compliance with all Federal and state laws, regulations, and environmental requirements; 2) Environmental Compliance—maintenance of compliance certification through monitoring and verifying the performance of the systems sensitive parameters; and 3) National Transuranic Waste Integration Program—integration and infrastructure activities required to certify the transuranic waste and coordinate all activities across the transuranic waste complex for shipments of waste to the Waste Isolation Pilot Plant. All legacy transuranic waste has been removed from 14 sites.

Although the volume of waste emplaced each year is somewhat dependent upon the specific waste streams shipped and payload constraints, the target shipping rate is expected to result in approximately 7,400 cubic meters in both FY 2010 and FY 2011. The table below shows the cumulative actual volumes of transuranic waste (in cubic meters) emplaced at the Waste Isolation Pilot Plant Repository by site and by fiscal year. Contact-handled transuranic waste disposal began in 1999; remote-handled transuranic waste disposal began in 2007.

Contact Handled (CH) Transuranic Waste Emplaced in the WIPP Repository, Cumulative Volume by Site (cubic meters)

Fiscal Year	LANL	INL	RFETS	Hanford	SRS	ANL-E	NTS	LLNL	ORNL	WIPP	Cumulative Total
FY 1999	190	15	62		0	0	0	0	0	0	267
FY 2000	0	87	252	13	0	0	0	0	0	0	619
FY 2001	74	717	1,044	68	62	0	0	0	0	0	2,584
FY 2002	8	2,065	2,903	18	141	0	0	0	0	1	7,720
FY 2003	327	567	4,017	250	2,285	97	0	0	0	0	15,263
FY 2004	0	342	4,650	448	3,240	24	106	0	0	0	24,073
FY 2005	171	2,564	2,134	853	1,554	0	235	146	0	0	31,730
FY 2006	546	7,890	0	715	1,340	0	64	0	0	0	42,285
FY 2007	823	5,390	0	765	1,548	0	0	0	0	0	50,811
FY 2008	689	3,304	0	622	1,267	0	0	0	12	0	56,705
FY 2009	727	4,621	0	9	719	0	0	0	37	3	62,821
Site Totals	3,555	27,562	15,062	3,761	12,156	121	405	146	49	4	62,821

Remote Handled (RH) Transuranic Waste Emplaced in the WIPP Repository, Cumulative Volume by Site (cubic meters)

Fiscal Year	LANL	INL	SRS	ANL-E	ORNL	GEVNC	Cumulative Total
FY 2007	0.0	22.7	0.0	0.0	0.0	0.0	22.7
FY 2008	0.0	47.4	0.0	2.5	0.0	0.0	72.6
FY 2009	14.2	15.7	18.4	7.4	5.0	0.6	133.9
Site Totals.	14.2	85.8	18.4	9.9	5.0	0.6	133.9

Site Completion (End-State)

All legacy transuranic waste across the DOE complex will be disposed of at the Waste Isolation Pilot Plant. The statutory limit for transuranic waste to be disposed there is 175,600 cubic meters, which includes 7,080 cubic meters for remote-handled transuranic waste. The surface area will remain under institutional controls for 100 years after the disposal phase ends.

In FY 2011, the following activities are planned:

- Maintain safety and personnel health programs, surface and underground operations and maintenance, program administration, generator site interface, public affairs programs, payments to the National Institute of Standards and Technology and other organizations for independent oversight, environmental oversight, and right-of-ways.

- Provide funding for 40 Code of Federal Regulations compliance, site environmental compliance, Resource Conservation and Recovery Act permit compliance, Quality Assurance, and payments to regulatory agencies.

- Provide funding for materials required for storage of contact-handled transuranic waste including slip sheets, and MgO (Magnesium Oxide), as well as engineering services and contact-handled transuranic waste handling. These are required for operations per the Environmental Protection Agency and the New Mexico Environment Department.

- Support handling of remote-handled waste, borehole drilling, and shield plugs required at the Waste Isolation Pilot Plant to receive and dispose of remote-handled transuranic waste.

- Support site maintenance items such as removing exhaust shaft surface duct salt build-up and several other similar projects.

- A portion of the scope of work typically covered in this project is being executed with American

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Provided large box characterization equipment to Savannah River (FY 2009)
- Submitted Compliance Recertification Application to EPA (FY 2009)
- Submitted Hazardous Waste Facility Permit Renewable Application (FY 2009)

CB-0081 / Central Characterization Project	**34,255**	**13,730**	**25,797**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project scope includes labor, materials, and supplies for operation of mobile waste characterization systems deployed to Department of Energy generator sites for characterization of transuranic waste to be disposed at the Waste Isolation Pilot Plant, as well as centralized transuranic waste analytical services at Idaho and the Carlsbad Environmental Monitoring and Research Center. It also includes generator site services at selected sites to characterize transuranic waste for transportation to Waste Isolation Pilot Plant or to another site for final certification, when cost-effective. The use of mobile systems provides host sites with a highly regulated program that has already been certified for use. DOE reviews have concluded that the Central Characterization Project provides the most cost-effective and reliable characterization capabilities. This project also provides a DOE-wide single certification program for remote-handled transuranic waste shipments to Waste Isolation Pilot Plant at the generator/shipping sites and a DOE-wide transuranic waste shipping confirmation process required by the Waste Isolation Pilot Plant Hazardous Waste Facility Permit issued by the New Mexico Environment Department.

Site Completion (End-State)

All eligible transuranic waste requiring use of the Central Characterization Project across the DOE complex will be disposed of at the Waste Isolation Pilot Plant. The surface area will remain under institutional controls for 100 years after the disposal phase ends.

In FY 2011, the following activities are planned:

- Provide funding for Acceptable Knowledge and procedural support, mobile waste loading support at select generator sites, waste certification support, headspace gas analysis, and soils and solids analysis required for characterization activities.
- Support generator site interface for the Central Characterization Project activities, Central

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Characterization Project administration, and Performance Demonstration Program for Resource Conservation and Recovery Act constituents.

- Support Central Characterization Project waste certification for transportation of waste consolidated at Idaho National Laboratory. The Central Characterization Project is the transportation certification program for all transuranic waste shipments from Idaho National Laboratory. (The Carlsbad Field Office will be dependent on Idaho National Laboratory to provide the waste.)
- Support Central Characterization Project for contact-handled and remote-handled transuranic waste at Los Alamos National Laboratory for disposal at the Waste Isolation Pilot Plant.
- Support Central Characterization Project for contact-handled and remote-handled transuranic waste at Oak Ridge National Laboratory for disposal at the Waste Isolation Pilot Plant.
- A portion of the scope of work typically covered in this project is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Initiated Oak Ridge National Laboratory remote-handled shipments (FY 2009)
- Started standard waste box characterization at the Los Alamos National Laboratory. (FY 2009)
- Initiated Savannah River Site remote-handled shipments (FY 2009)
- Completed Los Alamos National Laboratory remote-handled shipments from existing remote-handled inventory (FY 2009)
- Complete 28 Argonne National Laboratory remote-handled shipments (December 2009)

	FY 2009	FY 2010	FY 2011
CB-0090 / Transportation-WIPP	**32,108**	**33,851**	**30,678**

This PBS can be found within the Defense Environmental Cleanup appropriation.

It includes all transportation activities required to support the disposal of both contact-handled and remote-handled transuranic waste to the Waste Isolation Pilot Plant, or other designated sites. This includes carrier services, transportation packaging, shipping coordination, and stakeholder interfaces related to transportation. As required in the Waste Isolation Pilot Plant Land Withdrawal Act, this project provides for technical assistance for the purpose of training public safety officials and other emergency responders in any State or Indian tribal lands through which DOE plans to transport transuranic waste to or from the Waste Isolation Pilot Plant.

In FY 2011, the following activities are planned:

- Supports fixed-price portion of the carrier contracts and contact-handled packaging (TRUPACT-II) maintenance.
- Supports shipping corridor readiness, remote-handled waste packaging, and shipping services, including Nuclear Regulatory Commission fees.
- Supports the cost-reimbursable portion of the carrier contracts: fuel, state use fees and permits, New Mexico Gross Receipts Tax, driver per diem, and safe driving bonus.
- A portion of the scope of work typically covered in this project is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Projected Nuclear Regulatory Commission Approval of TRUPACT-III (March 2010) ▪ Maintain shipping capability at 25 contact-handled shipments per week (September 2010) ▪ Maintain shipping capability at 21 contact-handled shipments per week (September 2011) ▪ Remote-handling shipping capability goal is 5 per week (September 2011)					

CB-0101 / Economic Assistance to the State of New Mexico **26,909** **27,854** **28,771**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project fulfills a requirement of the Waste Isolation Pilot Plant Land Withdrawal Act, as amended, (Public Law 102-579) which authorizes payments to the State of New Mexico in the amount of $20,000,000 (adjusted for inflation) for each of the 14 fiscal years beginning with FY 1998. Annual payments to the State of New Mexico as required by Public Law 102-579 will be completed in FY 2011.

In FY 2011, the following activity is planned:

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Provides economic assistance payments to the State of New Mexico required by the Waste Isolation Pilot Plant Land Withdrawal Act, as amended, which is a Federal Law.

- Provides funds for state and local governments for road improvements, as needed, in connection with waste shipments to the Waste Isolation Pilot Plant.

- Provide funds to units of local government in Lea and Eddy counties.

- Provide for independent Environment Assessments and Economic Studies associated with the Waste Isolation Pilot Plant.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Provide funding to the State of New Mexico as required by the WIPP Land Withdrawal Act. (FY 2009/September 2010/September 2011)					

	FY 2009	FY 2010	FY 2011
Total, Carlsbad	**231,661**	**230,337**	**220,245**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup **Waste Isolation Pilot Plant** **CB-0080 / Operate Waste Disposal Facility-WIPP**	
▪ Decrease reflects the reallocation of WIPP resources necessary to optimize complex-wide TRU waste efforts. Funding for operations and site infrastructure is reduced from FY 2010 levels in order to augment waste characterization and certification activities necessary to increase the inventories of TRU waste available for shipment. This reallocation supports a steady-state shipping rate in FY 2011.	-19,903
CB-0081 / Central Characterization Project	
▪ Increase reflects greater level of characterization in this project over FY 2010 levels, where American Recovery and Reinvestment Act funds supplied majority	12,067

	FY 2011 vs. FY 2010 ($000)
of characterization activities at generator sites.	
CB-0090 / Transportation-WIPP	
▪ Decrease reflects reduced number of new shipping corridors required to be established in FY 2011.	-3,173
CB-0101 / Economic Assistance to the State of New Mexico	
▪ No significant change.	917
Total, Carlsbad	**-10,092**

Idaho

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Idaho National Laboratory	489,239	467,875	469,168	412,000
Total, Idaho	489,239	467,875	469,168	412,000

Site Overview

Since its establishment in 1949, the Idaho Site has fulfilled numerous Department of Energy (DOE) missions including the design and testing of 52 nuclear reactors and reprocessing spent nuclear fuel to recover fissile materials. These activities resulted in an inventory of high-level, transuranic, mixed low-level and low-level wastes, which are being disposed in accordance with applicable laws and regulations. The Idaho Cleanup Project includes treating, storing and disposing of a variety of radioactive and hazardous waste streams, cleaning up the environment, removing or deactivating unneeded facilities, and removal of DOE's inventory of spent nuclear fuel and high level waste from Idaho. The Idaho Cleanup Project is also responsible for storing and dispositioning approximately 284 metric tons of spent nuclear fuel from a number of sources, including the Navy, foreign and domestic research reactors, and some commercial reactors, along with DOE-owned fuel. In addition the Idaho Cleanup Project manages spent nuclear fuel at the Fort Saint Vrain Independent Spent Fuel Storage Installation in Colorado. The site is on the United States Environmental Protection Agency's National Priorities (Superfund) List, and environmental remediation activities are required at ten Waste Area Groups encompassing 100 operable units, including Naval Reactors Facility Waste Area Group 8, and Material Fuels Complex-West Waste Area Group 9.

American Recovery and Reinvestment Act Activities

The Idaho National Laboratory American Recovery and Reinvestment Act activities are funded at $467,875,000. Specifically, this funding will accelerate demolition of 89 excess nuclear and radiological facilities resulting in a footprint reduction of more than 812,000 square feet. With the American Recovery and Reinvestment Act funding, targeted waste retrieval per the July 2008 Agreement to Implement U. S. District Court Order dated May 25, 2006 will be accelerated; shipment of waste off-site for disposal will be accelerated; demolition of the excess nuclear and radiological facilities will also be accelerated. In addition, American Recovery and Reinvestment Act funding will also be used to treat and dispose of remote-handled transuranic waste and mixed low-level waste. Idaho National Laboratory will treat and ship off-site contact-handled transuranic waste received from other small sites from around the DOE complex greatly assisting these sites in their cleanup and closure.

Site Description

The Idaho Site is located in southeast Idaho, near the northeast end of Idaho's Snake River Plain, which extends in a broad arc from the Idaho-Oregon border on the west to the Yellowstone Plateau on the east. In 1991, the Environmental Protection Agency designated the Snake River Plain Aquifer a sole-source aquifer.

Although the total land area is 890 square miles, most of the cleanup work at the Idaho Site is performed within the site's primary facility areas: Idaho Nuclear Technology and Engineering Center, Radioactive Waste Management Complex, Advanced Test Reactor Complex (formerly the Test Reactor Area), and Materials and Fuels Complex (formerly Argonne National Laboratory-West).

The Idaho Nuclear Technology and Engineering Center is situated on 210 acres within a perimeter fence and approximately 55 acres located outside the fence. High-level waste (calcine) in bin sets, sodium-bearing waste within tanks and spent nuclear fuel in wet and dry storage represent the major cleanup activities, in addition to remediation of two active Comprehensive Environmental Response, Compensation, and Liability Act Operable Units.

The Radioactive Waste Management Complex consists of 86 facilities and is a controlled area for management and disposal of solid radioactive wastes. It includes a 97-acre Subsurface Disposal Area within a security fence, buildings for Resource Conservation and Recovery Act compliant storage of hazardous transuranic waste, and administration and support buildings. The Subsurface Disposal Area will be remediated under the WAG 7 OU 7-13/14 Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision. The above-ground, stored transuranic waste is being treated at the Advanced Mixed Waste Treatment Facility and shipped to the Waste Isolation Pilot Plant for disposal.

The Test Area North was 220 acres at the north end of the Idaho National Laboratory Site. Test Area North was established in the 1950s by the United States Air Force and the Atomic Energy Commission Aircraft Nuclear Propulsion Program to support nuclear-powered aircraft research. One building remains and is used by the Department of Defense. Active Comprehensive Environmental Response, Compensation, and Liability Act remedial actions remain, such as groundwater bioremediation and pump-and-treat actions.

The Advanced Test Reactor Complex covers about 102 acres in the southwest portion of the Idaho Site. The major mission of the Reactor Technology Complex is to conduct scientific and engineering experiments for both nuclear and non-nuclear programs. The Reactor Technology Complex was established in the early 1950s. Demolition of the Materials Test Reactor and Engineering Test Reactor is complete. The Advanced Test Reactor continues to operate today.

Site Cleanup Strategy/Scope of Cleanup

Over the past decade, considerable progress has been made toward addressing legacy waste and contamination at the Idaho Site:

- Over 1,300,000 square feet of facilities have been deactivated and decommissioned to date;

- Of the 689 Comprehensive Environmental Response, Compensation, and Liability Act sites identified as being potentially contaminated, 89 percent (612 sites) have been cleaned up and have been determined not to pose any risk to a current or future resident, or resides within an Industrial Use Area under future governmental control;
- Over eight million gallons of high-level liquid waste were calcined (dried into a powdered form) into about 4,400 m^3 of calcine. Reduced the volume of liquid waste remaining in the tank farm to approximately one million gallons of sodium-bearing waste;
- Eleven of 15 High Level Waste Tanks have been emptied, cleaned and grouted; (Seven—300,000 gallon tanks and Four—30,000 gallon tanks);
- At the end of FY 2009, approximately 30,000 m^3 of contact-handled transuranic waste had been shipped offsite for disposal;
- Over 55,000 m^3 of low-level waste has been disposed;
- By the end of 2010 all EM-assigned spent nuclear fuel will have been consolidated into dry storage;
- Substantial quantities of volatile organic compounds have been extracted and destroyed from the vadose zone beneath the Radioactive Waste Management Complex and Test Area North;
- Voluntary Consent Order activities at the Idaho Nuclear Technology and Engineering Center include closing 41 tank systems under the Resource Conservation and Recovery Act guidelines.

Site Completion (End-State)

The EM end-state vision is as follows:

- By 2012, the Idaho Site will have achieved significant risk reduction and will have placed materials in safe storage ready for disposal.
- By 2035, all spent nuclear fuel must be shipped offsite and high-level waste (calcine) must be ready to ship, to comply with the Idaho Settlement Agreement.
- The lifecycle planning estimate range is 2035 to 2044.

Idaho Nuclear Technology and Engineering Center

- Demolish or disposition all EM excess facilities and Nuclear Facilities transferred to EM;
- Treat for transportation out of Idaho liquid sodium-bearing waste stored in underground tanks;
- Empty and disposition all Tank Farm Facility tanks;
- Ship all EM spent nuclear fuel out of the state;
- Disposition all excess special nuclear material (completed);
- Complete implementation of the Waste Area Group 3 Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision for Operable Unit 3-13 and Operable Unit 3-14;
- Place calcine (4,400 m^3) in a condition that is road-ready for shipment out of the state by 2035.

Radioactive Waste Management Complex

- Complete shipments of stored contact-handled transuranic waste to the Waste Isolation Pilot Plant;
- Demolish and remove facilities no longer needed;
- Complete implementation of the Waste Area Group 7 Record of Decision for Operable Unit 7-13/14 through the Phase I Remedial Design Remedial Action Work Plan by remediating buried transuranic waste.

Test Area North

- Demolish all remaining EM facilities (facilities required for groundwater remediation remain) (completed);
- Complete Comprehensive Environmental Response, Compensation, and Liability Act groundwater remedial actions including in-situ bioremediation, pump and treat, and natural attenuation (Operable Unit 1-07B);
- Complete all activities in the future Comprehensive Environmental Response, Compensation, and Liability Act actions, covered under the site-wide Record of Decision 10-08.

Site-wide

- Complete implementation of the Waste Area Group 10 Record of Decision for Operable Unit OU-10-08 for site-wide groundwater, miscellaneous sites at the Idaho National Laboratory;
- Complete implementation of the Waste Area Group 10 Record of Decision for Operable Unit OU-10-04 for unexploded ordinance.

Advanced Test Reactor Complex

- Demolish all EM-owned facilities and any Nuclear Energy liabilities transferred to EM (completed);
- Disposition the Engineering Test Reactor and the Power Burst Facility Reactor under the Comprehensive Environmental Response, Compensation, and Liability Act and complete all voluntary Consent Order actions (completed).

Regulatory Framework

There are three primary regulators of the Idaho Site: the United States Environmental Protection Agency, the United States Nuclear Regulatory Commission, and the State of Idaho Department of Environmental Quality. The International Atomic Energy Agency also regulates/monitors via treaty. Several compliance agreements, amendments and consent orders executed between 1991 and 2000 govern cleanup work at the Idaho National Laboratory Site. Those agreements encompass the majority of the cleanup requirements and commitments. The five primary agreements are:

Federal Facility Agreement and Consent Order (1991): The *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* between the DOE, the United States Environmental Protection Agency, and Idaho Department of Environmental Quality established a strategy and plan for cleanup at the Idaho Site. The agreement divides the Idaho Site into 10 waste area groups based on similar characteristics or geographic boundaries. Nine groups generally correspond to the Site's major facility areas. The tenth group assesses overall risk to the aquifer beneath the Site, addresses sites outside the boundaries of the Idaho Site's primary facility areas, and allows for inclusion of newly identified release sites.

Notice of Non-Compliance Consent Order (1992): This consent order (between DOE, the State of Idaho Department of Environmental Quality, and the United States Environmental Protection Agency) establishes actions and milestones to resolve Resource Conservation and Recovery Act inspection issues including configuration of stored transuranic waste and high-level waste in the Idaho Nuclear Technology and Engineering Center tank farm.

Idaho Settlement Agreement (1995): This agreement (between DOE, State of Idaho, and United States Navy) resolved a lawsuit regarding the receipt of spent nuclear fuel at the Idaho National Laboratory. The agreement specifies milestones such as the removal of all spent nuclear fuel from Idaho Site by 2035 and treatment of liquid high level radioactive waste by December 31, 2012.

Voluntary Consent Order (2000): The *Consent Order* (Idaho Department of Environmental Quality 2000) is an enforceable agreement with the Idaho Department of Environmental Quality that governs resolution of self-disclosed Resource Conservation and Recovery Act issues, most of which were related to the closure of 912 tanks and tank systems.

Site Treatment Plan: To fulfill requirements in the1992 Federal Facility Compliance Act, the Idaho National Engineering Laboratory prepared the *Idaho National Engineering Laboratory Site Treatment Plan* to address the treatment and long-term storage of mixed low-level waste (radioactive waste mixed with hazardous chemicals). The plan also has prescriptive schedules and requirements on processing of mixed waste. This enforceable plan was approved by the State of Idaho and is updated annually.

Section 3116 of the Ronald W. Reagan National Defense Authorization Act: The Federal Facility Agreement defines the enforceable commitments for completing the closure of non-compliant tanks at Idaho. Originally all tanks were to be closed in accordance with the waste incidental to reprocessing methodology in DOE Order 435.1. In October 2004, Congress passed the Ronald W. Reagan National Defense Authorization Act of FY 2005 (Public Law 108-375,). Section 3116 of the National Defense Authorization Act allows the Secretary of Energy, in consultation with the Nuclear Regulatory Commission, to determine when waste from reprocessing of spent nuclear fuel is appropriate for onsite disposition as other than high level waste when certain criteria are met. To meet criteria established in the statute, DOE must remove waste to the maximum extent practical and submit waste determinations to Nuclear Regulatory Commission for review.

Critical Project Uncertainties and Assumptions

Current disposal pathways and schedules for spent nuclear fuel and calcined high-level waste are dependent on the new strategy for nuclear waste management and disposal. In the interim, the calcine and spent nuclear fuel is being stored safely.

Interdependencies

The Idaho Site's current interdependencies are: availability of shipping assets (containers, tractors, trailers and drivers) for the shipment of transuranic waste to the Waste Isolation Pilot Plant; availability of acceptable knowledge documentation; delivery of the remote-handled transuranic waste acceptance criteria; availability of spent nuclear fuel data, and inter-site coordination for foreign and domestic research reactor receipts. Off-site disposition of the high-level waste and spent nuclear fuel is required.

Contract Synopsis

The Idaho Site EM Program focuses on cleaning up historic contamination at the site. The primary EM site contractors are Bechtel BWXT Idaho, LLC, for operation of the Advanced Mixed Waste Treatment Project through September 30, 2009, with options for extension through March 2010, which supports transuranic waste shipments to the Waste Isolation Pilot Plant, and the CH2M Hill Washington Group, whose contract extends through September 30, 2012. A final Advanced Mixed Waste Treatment Project contract is scheduled to be issued in FY 2010.

Cleanup Benefits

Cleanup of the Idaho Site will reduce the risk of contamination of the Snake River Plain Aquifer from nuclear and hazardous waste and will eliminate infrastructure, surveillance and maintenance costs by aggressively reducing the footprint through consolidation of cleanup operations, (primarily to the Idaho Nuclear Technology and Engineering Center), and deactivation and decommissioning of facilities at several other Idaho Site areas.

The Idaho Site has packaged and shipped all nuclear material off-site and all EM-owned spent nuclear fuel will be stabilized in interim dry storage. By 2012, the west side of the Tank Farm Facility will be closed, and most facilities demolished at three facility areas (Power Burst Facility, Test Area North, and Reactor Technology Complex). The remaining facilities will be in a cold, dark, and dry status, awaiting final disposition.

The targeted transuranic waste identified in the current Idaho Cleanup Project contract, that is buried in the Subsurface Disposal Area will be retrieved and shipped out of Idaho, the stored remote-handled transuranic waste, including the remote-handled transuranic waste that was transferred from the Office of Nuclear Energy to EM in 2009 (located at the Materials and Fuels Complex) will be packaged and shipped to the Waste Isolation Pilot Plant; the liquid sodium bearing waste will have been retrieved and stabilized; the remaining Tank Farm Facility tanks closed; and the EM footprint will have been consolidated to two facility areas.

Direct maintenance and repair at the Idaho National Laboratory is estimated to be $28,598,000.

Funding Schedule by Activity

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Idaho National Laboratory			
Idaho National Laboratory			
ID-0012B-D / SNF Stabilization and Disposition-2012 (Defense)	16,000	34,268	43,337
ID-0013 / Solid Waste Stabilization and Disposition	175,000	143,500	172,631
ID-0014B / Radioactive Liquid Tank Waste Stabilization and Disposition-2012	156,600	185,550	118,273
ID-0030B / Soil and Water Remediation-2012	95,000	91,500	68,959
ID-0040B / Nuclear Facility D&D-2012	29,294	5,450	0
ID-0100 / Idaho Community and Regulatory Support	3,867	3,900	3,900
Subtotal, Idaho National Laboratory	475,761	464,168	407,100
Non-Defense Environmental Cleanup			
Small Sites			
Idaho National Laboratory			
ID-0012B-N / SNF Stabilization and Disposition-2012 (Non-Defense)	13,478	5,000	4,900
Total, Idaho	489,239	469,168	412,000

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Idaho					
Geographic Sites Eliminated (number of sites)	4	4	4	5	80.0%
Enriched Uranium packaged for disposition (Number of Containers)	1,586	1,586	1,586	1,586	100.0%
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	6,660	0%
Industrial Facility Completions (Number of Facilities)	143	143	143	255	56.1%
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	100	900	11.1%
Liquid Waste Tanks closed (Number of Tanks)	7	7	7	11	63.6%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	67,688	69,518	71,568	109,114	65.6%
Material Access Areas eliminated (Number of Material Access Areas)	1	1	1	1	100.0%
Nuclear Facility Completions (Number of Facilities)	28	28	28	92	30.4%
Radioactive Facility Completions (Number of Facilities)	35	35	35	68	51.5%
Remediation Complete (Number of Release Sites)	520	599	603	636	94.8%
Spent Nuclear Fuel packaged for final	0	0	0	253	0%

disposition (Metric Tons of Heavy Metal)					
Transuranic Waste shipped for disposal (Cubic meters) - CH	35,423	41,123	46,823	83,155	56.3%
Transuranic Waste shipped for disposal (Cubic meters) - RH	92	92	92	117	78.6%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
ID-0012B-D / SNF Stabilization and Disposition-2012 (Defense)	**16,000**	**34,268**	**43,337**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The scope of this project includes stabilizing legacy spent nuclear fuel through 2012 and managing the receipt of off-site spent nuclear fuel shipments. EM currently manages and stores approximately 262 metric tons of spent nuclear fuel at the Idaho Site. The EM plan includes the receipt of approximately 22 metric tons of spent nuclear fuel from off-site locations, including Foreign and Domestic Research Reactor spent nuclear fuel from FY 2005 through FY 2027. The plan also includes the receipt of approximately 0.5 metric tons of spent nuclear fuel through FY 2012 from the on-site operating Advanced Test Reactor. This project includes support costs for the National Spent Nuclear Fuel Program.

This project includes costs to accelerate the transfer of 3,186 fuel handling units of legacy spent nuclear fuel from wet to dry storage ahead of the Idaho Settlement Agreement date of FY 2023.

In FY 2011, the following activities are planned:

- Maintain the Chemical Processing Plant building-666 and wet stored fuel assigned to Navy or Nuclear Energy.
- Maintain all dry fuel storage facilities and upgrade the Chemical Processing Plant building-603.
- Evaluate nuclear fuel storage requirements, perform facility aging analyses, and perform facility maintenance upgrades.
- Receive and unload Domestic and Foreign Research Reactor spent nuclear fuel.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Receive Foreign Research Reactor and Domestic Spent Nuclear Fuel shipments. (FY 2009/September 2010/September 2011)

- Receive up to 31 Advanced Test Reactor fuel shipments (September 2010/September 2011)
- Complete transfer of all EM-owned SNF to dry storage (September 2010)

ID-0013 / Solid Waste Stabilization and Disposition	**175,000**	**143,500**	**172,631**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This waste treatment and disposal activity accelerates the disposition of stored transuranic waste, low-level waste, Resource Conservation and Recovery Act hazardous waste, and mixed low-level waste backlog; closes on-site low-level waste disposal facilities at the Radioactive Waste Management Complex; and accelerates the consolidation of waste management facilities to reduce operating costs. The various waste inventories to be disposed by this project were generated primarily by other DOE sites and also by active operations at the Idaho Site. Approximately 65,000 m^3 of stored transuranic waste and alpha mixed low-level waste (comprised of both contact-handled and remote-handled waste) will be characterized, treated, and shipped to the Waste Isolation Pilot Plant or another suitable disposition site. A backlog of legacy mixed low-level waste (approximately 2,250 m^3) has been eliminated. In 2009, 34 cubic meters of remote-handled mixed low-level waste was transferred from the Office of Nuclear Energy to EM.

Contact-handled transuranic waste will be processed in the Advanced Mixed Waste Treatment Facility and shipped to the Waste Isolation Pilot Plant for disposal. On-site low-level waste disposal at the Radioactive Waste Management Complex will continue for remote-handled low-level waste. The scope of this project includes environmental monitoring and compliance activities for air, water, waste, soils, and biota surveillance; and supports the Environmental Oversight and Monitoring Agreement within the State of Idaho.

Disposal of contact handled low-level waste at the Radioactive Waste Management Complex has ceased, but disposal of remote-handled low-level waste in the Subsurface Disposal Area will continue for several more years. Mixed low-level waste is disposed off site at either the Nevada Test Site or Energy Solutions in Utah.

In FY 2011, the following activities are planned:

- Provide for site-wide environmental compliance.
- Maintenance and operation of the Radioactive Waste Management Complex infrastructure including utility systems, project management, engineering, training, environmental safety and health and quality assurance. This project also includes monitoring of air, water, soils, and biota surveillance.
- Meet requirements of the Idaho Settlement Agreement by disposing of remote-handled low-level

waste at the Radioactive Waste Management Complex disposal pit; disposing of mixed low-level waste at appropriate off-site disposal facilities; characterize and certify remote-handled transuranic waste at the Idaho Nuclear Technology and Engineering Center in preparation for shipment to the Waste Isolation Pilot Plant; prepare facilities and equipment for transfer and treatment of sodium contaminated remote-handled transuranic and mixed low-level waste; ship stored contact-handled transuranic waste to the Waste Isolation Pilot Plant using the Advanced Mixed Waste Treatment Facility; and receive, characterize, certify, transuranic waste from other DOE sites in preparation for shipment to the Waste Isolation Pilot Plant.

- Address issues and challenges related to higher risk activities and more difficult stored contact handled transuranic waste containers.
- A portion of the scope of work typically covered in this project is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	33,795	39,495	45,195	66,700	68.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	92	92	92	117	79.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	67,688	69,518	71,568	77,953	92.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Ship 5,700 cubic meters of contact-handled transuranic waste to the Waste Isolation Pilot Plant (FY 2009/September 2010/September 2011)
- Disposed of 3,805 cubic meters of low-level waste and mixed low-level waste (FY 2009)
- Dispose of 1,400 cubic meters of low-level waste and mixed low-level waste (September 2010)
- Ship 7 cubic meters of remote-handled-transuranic waste to the Waste Isolation Pilot Plant (September 2010)
- Ship 2,050 cubic meters of mixed/low-level waste (September 2011)

ID-0014B / Radioactive Liquid Tank Waste Stabilization and Disposition-2012 **156,600** **185,550** **118,273**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The overall objectives of this project are to treat and dispose of the sodium-bearing tank wastes, close the tank farm tanks, and maintain Idaho Nuclear Technology and Engineering Center. The primary focus is the design, construction, and operation of a facility that will retrieve and treat the sodium bearing liquids and associated tank solids for disposal off-site.

This project also includes activities to support the preparation of stored high-level waste calcine for final disposition. These activities include: 1) development of bin set retrieval technology; 2) Resource Conservation and Recovery Act regulatory initiatives to allow disposal of calcine; 3) issuance of a Record of Decision in 2009 and calcine treatment technology and development; 4) conceptual and preliminary design; and 5) submission of a Resource Conservation and Recovery Act Part B Permit in 2012.

This project includes design and construction of the Sodium Bearing Waste Treatment Facility. $86,700,000 was appropriated in FY 2009 for construction of the facility (06-D-401), $93,700,000 was appropriated in FY 2010, and $6,500,000 is requested in FY 2011.

In FY 2011, the following activities are planned:

- Complete the sodium-bearing waste treatment facility testing and readiness verification in preparation of a hot startup in FY 2011.

- Continue providing acceptable Idaho Nuclear Technology and Engineering Center utilities, maintenance and operations for the process waste system, support labs, and existing process facilities.

- Continue Liquid Waste Facility closure activities, and provide safe Resource Conservation and Recovery Act compliant operations.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	100	900	11.0%
Liquid Waste Tanks closed (Number of Tanks)	7	7	7	11	64.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Issued Record of Decision (ROD) for the Environmental Impact Statement for path forward to treat calcine waste (December 2009)
- Continue Liquid Waste Facility closure activities (December 2010)
- Continue construction of the Sodium Bearing Waste Project (December 2010)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
ID-0030B / Soil and Water Remediation-2012	**95,000**	**91,500**	**68,959**

- Commence Sodium Bearing Waste operations (August 2011)
- Complete construction of the Sodium Bearing Waste Project (August 2011)

This PBS can be found within the Defense Environmental Cleanup appropriation.

The objective of this project is remediation of contaminated soil and groundwater and closure of legacy Resource Conservation and Recovery Act issues at the Idaho National Laboratory Site via a Voluntary Consent Order, to reduce risk to the Snake River Plain Aquifer.

This project scope also includes all environmental monitoring to confirm effectiveness of selected record of decision remedies for protection of the Snake River Plain Aquifer and maintenance of institutional controls. In addition, assessment of the contamination present, the risk of aquifer contamination, and the technical removal and disposal of chemical contamination, stabilization of short-lived radioactive contamination, controlling access through institutional controls, consolidation of mixed waste in the Idaho Comprehensive Environmental Response, Compensation, and Liability Act Disposal Facility, implementation of groundwater bioremediation, and implementation of long-term monitoring of the aquifer and ecosystem.

In FY 2011, the following activities are planned:

- Continue risk reduction through implementation of the Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision for buried transuranic waste at the Waste Area Group 7 (Radioactive Waste Management Complex) subsurface disposal area.
- Continue shipping retrieved Waste Area Group 7 contact-handled targeted waste out of Idaho for disposal.
- Continue groundwater treatment and monitoring at Waste Area Group 1 (Test Area North).
- Continue maintenance of remedies at Waste Area Group 2 (Test Reactor Area); Waste Area Group 4 (Central Facility Area); Waste Area Group 5 (Power Burst Facility/Auxiliary Reactor Area); and Waste Area Group 6 (Experimental Breeder Reactor/BORAX).
- Continue implementation of the Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision for the Waste Area Group 3 (Idaho Nuclear Technology and Engineering Center) tank farm soils and groundwater.
- Continue implementation of the Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision for Waste Area Group (OU 10-08 (Site wide) site wide ground

water, miscellaneous sites, and future sites.

- Continue implementation of the Comprehensive Environmental Response, Compensation, and Liability Act Record of Decision for Waste Area Group 10 (OU 10-04) unexploded ordinance.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	1,628	1,628	1,628	9,057	18.0%
Remediation Complete (Number of Release Sites)	250	329	333	343	97.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Completed retrieval operational period for Accelerated Retrieval Project II for Pits 4 & 6 (FY 2009)
- Continued buried waste retrievals ~850 cubic meters (FY 2009)
- Complete Waste Area Group 3 Operable Unit 3-13 Group 3 Surface Sites Remediation (FY 2009)
- Submit for review the Remedial Design Remedial Action Work Plan for review for Waste Area Group 10 Operable Unit 10-08 (June 2010)
- Continue buried waste retrievals ~1800 cubic meters per year (September 2010/September 2011)
- Continue buried waste retrievals ~650 cubic meters per agreement with the Carlsbad Field Office. (September 2010)
- Plan to dispose of 4718 cubic meters of low-level and mixed low-level wastes generated from ER & D&D Activities (October 2010)
- Conduct five-year Comprehensive Environmental Response, Compensation, and Liability Act review. (October 2010)
- Submit Draft Operable Unit 10-04 Phase III Remedial Action Report for gunrange lead contamination (March 2011)
- Projected to complete Phase IV of the Waste Area Group 10 Operable Unit 10-04 Remedial Action (September 2011)
- Projected to complete Phase I of the Waste Area Group 3 Operable Unit 3-14 Remedial Action (September 2011)

ID-0040B / Nuclear Facility D&D-2012 **29,294** **5,450** **0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project scope includes deactivation and final disposition of EM-owned, high-risk radiologically contaminated Idaho National Laboratory buildings, deactivation of four spent fuel storage pools (completed), disposition of four excess nuclear test reactors, and disposition of a nuclear fuel reprocessing complex. The spent fuel storage pools contained contaminated water which could leak into the Snake River Plain Aquifer-- a critical concern for regional stakeholders and State agencies. The total contaminated water volume in the four pools was nearly 2.5 million gallons. The spent nuclear fuel storage pools have had spent fuel removed and all four basins have been dewatered with remediation actions completed.

In FY 2011, no activities are planned:

- No planned accomplishments in FY 2011; the scope of work typically covered in this project is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	28	28	28	59	47.0%
Radioactive Facility Completions (Number of Facilities)	0	0	0	23	0%
Industrial Facility Completions (Number of Facilities)	0	0	0	35	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Completed Final decommissioning of the Polychlorinated Biphenyl Facility Reactor Building (FY 2009)
- Completed decommissioning of the CPP Coal Plant (FY 2009)

ID-0100 / Idaho Community and Regulatory Support	**3,867**	**3,900**	**3,900**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project scope includes work in three major areas for environmental regulatory oversight and stakeholder interactions and support:

1) State of Idaho Department of Environmental Quality Grant and Air Quality Permitting Fees.

2) The United States Geological Survey performs groundwater monitoring and subsurface investigation on the regional (Eastern Snake River Plain Aquifer) and subregional (site-wide) scale for the Idaho Site.

3) The Idaho Site Citizens Advisory Board is chartered by the DOE as an EM Site-Specific Advisory Board.

In FY 2011, the following activities are planned:

- Continue the United States Geological Survey groundwater monitoring and subsurface investigation with analysis of contaminants and transport mechanisms affecting the Snake River Aquifer, both on-site and off-site.
- Payment of fees for the Title V Air Permit and technical assistance for air quality compliance.
- Continue support for the Idaho Site Citizen Advisory Board.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ DEQ Grants enable obtaining closure plans, permits/permit mods; Comprehensive Response, Compensation, and Liability Act (FY 2009/ September 2010) ▪ DEQ grants will enable obtaining hazardous waste management closure plans, permits or permit mods; Comprehensive Response, Compensation, and Liability Act (September 2010/September 2011)					

ID-0012B-N / SNF Stabilization and Disposition-2012 (Non-Defense) 13,478 5,000 4,900

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The purpose of this project is to maintain and operate the Nuclear Regulatory Commission licensed facilities. This includes the management of approximately 15 metric tons of spent nuclear fuel presently stored at Fort St. Vrain in Colorado and approximately 82 metric tons of spent nuclear fuel presently stored on-site in the Three Mile Island Independent Spent Nuclear Fuel Storage Installations. Currently, the two facilities continue to operate within their license.

In FY 2011, the following activities are planned:

- Provide payments to the Nuclear Regulatory Commission for licensing-related activities related to both Fort St. Vrain and Three Mile Island-2 Spent Nuclear Fuel.
- Provide security for Fort St. Vrain Spent Nuclear Fuel.
- Monitor Three Mile Island-2 Spent Nuclear Fuel.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
Total, Idaho	**489,239**	**469,168**	**412,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Idaho National Laboratory	
ID-0012B-D / SNF Stabilization and Disposition-2012 (Defense)	
▪ Increase is attributable to the Building 603 infrastructure upgrades to permit additional wet to dry storage of spent nuclear fuel.	9,069
ID-0013 / Solid Waste Stabilization and Disposition	
▪ Increase will permit greater volumes of stored contact-handled transuranic waste to be shipped to the Waste Isolation Pilot Plant. It will also allow for more time consuming and riskier work to be completed in preparation for disposal. In addition, more mixed low-level and low-level waste can be disposed.	29,131
ID-0014B / Radioactive Liquid Tank Waste Stabilization and Disposition-2012	
▪ Decrease is due to the completion of fabrication and procurement activities; construction and construction turnover activities at the Sodium Bearing Waste Treatment Facility with hot start up expected in FY 2011.	-67,277
ID-0030B / Soil and Water Remediation-2012	
▪ Decrease is due to increased exhumations of buried contact-handled transuranic waste in FY 2010 using uncosted carryover of the American Recovery and Reinvestment Act funding.	-22,541
ID-0040B / Nuclear Facility D&D-2012	
▪ Decrease reflects decontamination and decommissioning near term work-scope being completed using uncosted carryover from the American Recovery and Reinvestment Act funding.	-5,450

	FY 2011 vs. FY 2010 ($000)
Non-Defense Environmental Cleanup	
Small Sites	
ID-0012B-N / SNF Stabilization and Disposition-2012 (Non-Defense)	
▪ No significant change.	-100
Total, Idaho	**-57,168**

06-D-401, Sodium Bearing Waste Treatment Project, Idaho National Laboratory (INL) Idaho Project Data Sheet (PDS) is for PED/Construction

1. Significant Changes

The most recent DOE Order 413.3A approved critical decision is Critical Decision-3c, start of construction, approved on August 28, 2007 with a Total Project Cost of $461,608K. The latest approved baseline change was on December 8, 2008 with a Total Project Cost of $570,893K. A Federal Project Director with certification level II has been assigned to this project.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2006	2Q FY2005	N/A	4Q FY2006	N/A	1Q FY2008	3Q FY2009	TBD	TBD
FY 2007	4Q FY2005	N/A	1Q FY2007	N/A	1Q FY2007	3Q FY2008	N/A	N/A
FY 2006 Reprogram	4Q FY2005	N/A	2Q FY2007	N/A	3Q FY2007	2Q FY2009	N/A	N/A
FY 2008	4Q FY2005	N/A	3Q FY2007	N/A	3Q FY2007	4Q FY2010	N/A	N/A
FY 2009	4Q FY2005	4Q FY2005	4Q FY2007	1Q FY2007	4Q FY2007	4Q FY2010	N/A	N/A
FY 2009 Notification	4Q FY2005	4Q FY2005	4Q FY2007	1Q FY2007	4Q FY2007	4Q FY2011	N/A	N/A
FY 2010	4Q FY2005	4Q FY2005	4Q FY2007	1Q FY2007	4Q FY2007	4Q FY2011	N/A	N/A
FY 2011	4Q FY2005	4Q FY2005	4Q FY2007	1Q FY2007	4Q FY2007	4Q FY2011	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work
Note (D&D): The "one-for-one" requirement is planned to be offset with D&D "banked excess".

(fiscal quarter or date)

	Performance Baseline Validation	CD-2/3A (Start of Construction for long lead items)	CD-3B (Early Site Preparation)	CD-3C (Start Balance of Construction)	CD-4			
FY 2006								
FY 2007								
FY 2006 Reprogram								
FY 2008								
FY 2009	1Q FY2007	4Q FY2006	1Q FY2007	TBD	TBD			
FY 2009 Notification	1Q FY2007	4Q FY2006	1Q FY2007	4Q FY2007	4Q FY2011			
FY 2010	1Q FY2007	4Q FY2006	1Q FY2007	4Q FY2007	4Q FY2011			
FY 2011	1Q FY2007	4Q FY2006	1Q FY2007	4Q FY2007	4Q FY2011			

CD-2A/3A/3B: Long Lead for Equipment, Early Site Preparation
CD-3C: Start Balance of Construction
CD-4: Approve Start of Operations or Project Closeout

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2006	54,280	250,230	304,510	74,700	0	74,700	379,210
FY 2007	54,188	249,992	304,180	74,700	0	74,700	378,880
FY 2008	86,188	257,520	343,708	117,900	0	117,900	461,608
FY 2009	86,188	269,620	355,808	105,800	0	105,800	461,608
FY 2009 Notification	86,188	351,170	437,358	133,535	0	133,535	570,893
FY 2010	86,188	351,170	437,358	133,535	0	133,535	570,893
FY 2011	86,188	360,229$^{(1)}$	446,417$^{(1)}$	124,476$^{(1)}$	0	124,476$^{(1)}$	570,893

Note (D&D): The "one-for-one" requirement is planned to be offset with D&D "banked excess".
The FY 2008 and FY 2009 values in this table include $37,500,000 of pre Critical Decision-0 Other Project Costs for this project, which was not explicitly identified in the previous data sheet values.

(1) – The FY 2010 Budget included a plus up in TEC, Construction which is offset by corresponding decrease to OPC.

The Total Estimated Cost includes design funds requested under Project Engineering and Design 04-D-414. Other Project Costs except D&D total includes contractor fee.

4. Project Description, Justification, and Scope

This project supports the equipment procurement, construction, construction management, quality assurance, and project management for the Sodium Bearing Waste Treatment Project. The design effort will develop the final detailed design of the treatment facility and establish the scope, schedule, and cost baselines for the project. Design funding has been appropriated on a separate Project Engineering and Design line item project (04-D-414). The Sodium Bearing Waste Treatment Project is one of several projects that are managed under Idaho National Laboratory's Idaho Cleanup Project and are part of the process to close the Idaho Nuclear Technology and Engineering Center's Tank Farm Facility. In order for these projects to meet the cleanup schedule, they will be managed together and their activities coordinated under the Idaho Cleanup Project.

The Sodium Bearing Waste Treatment Project supports the Department of Energy's EM mission of safely storing/treating liquid radioactive wastes. The Sodium Bearing Waste Treatment Project, as planned, supports the EM cleanup initiative and reduces risk to the environment. In addition, it supports several Federal Facilities Compliance Act commitments made with the State of Idaho.
The current DOE mission at the Idaho Nuclear Technology and Engineering Center includes cleaning up and managing radioactive and hazardous waste previously generated from nuclear fuel reprocessing activities. One of the major remaining waste forms is liquid mixed transuranic waste, which is stored in three of the eleven tanks. This waste is locally defined as sodium bearing waste due to its high content of sodium and potassium. Sodium Bearing Waste and Newly Generated Liquid Waste were primarily generated from past and on-going waste management and decontamination activities at Idaho Nuclear Technology and Engineering Center. The present inventory of approximately 900,000 gallons of sodium bearing waste is stored in three 300,000 gallon, underground tanks in the Tank Farm Facility with one 300,000 gallon spare tank. These tanks are between 35 and 45 years old and were constructed prior to the establishment of the Resource Conservation and Recovery Act regulations. These four tanks are located in concrete vaults of a design that do not meet present structural safety requirements (the "pillar and panel vaults"), and none of the tanks have secondary containment capabilities that meet current Resource Conservation and Recovery Act regulations. The waste management/storage systems at Idaho Nuclear Technology and Engineering Center currently operate under Resource Conservation and Recovery Act Part A interim status and a notice of non-compliance consent order.

A series of disputes over waste management and treatment, new waste, and spent nuclear fuel shipments into the State of Idaho resulted in a court-ordered Settlement Agreement between Idaho, the DOE and the U.S. Navy in October 1995. Among other things, the Settlement Agreement requires DOE to "cease-use" of the Tank Farm Facility tanks by December 31, 2012, because of their age, Resource Conservation and Recovery Act non-compliant configuration, and the seismic risk of potential release of their contents to the underlying Snake River Plain Aquifer. The evacuation of the tank contents by "calcination" (or other treatment) is also required. The 1998 Notice of Noncompliance-Consent Order Modification also requires cease-use of the Tank Farm Facility by December 31, 2012.

The scope and primary goal of the project is to design and construct a treatment process system using the steam reforming process to treat the sodium bearing waste (including solids) currently stored in the Tank Farm Facility tanks, along with any newly generated liquid waste produced through 2012.

The Sodium Bearing Waste Treatment Project has unique political, technical, cost, and schedule risks. The facility will mitigate two major technical risks by being designed and constructed so that it can treat sodium bearing waste and could be converted to allow processing of the calcine high level waste suitable for transport outside Idaho. These design features include increased cell shielding and seismic protection. Further facility and equipment upgrades would be needed to develop these additional capabilities if they become necessary.

The FY 2011 budget request will accomplish the following:

- Completion of Fabrication and Procurements Activities
- Completion of Construction Activities
- Completion of Construction Turnover Activities

The project is being conducted in accordance with the project management requirements in DOE O 413.3A and DOE M 413.3-1, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

	(dollars in thousands)		
	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED			
FY 2004	20,379	0	0
FY 2005	24,701	45,080	4,000
FY 2006	41,108	41,108	50,088
FY 2007	0	0	28,831
FY 2008	0	0	3,269
FY 2009	0	0	0
FY 2010	0	0	0
FY 2011	0	0	0
Total, PED	86,188	86,188	86,188
Construction			
FY 2006	30,729	30,729	1,418
FY 2007	31,000	31,000	43,932
FY 2008	111,600	111,600	76,837
FY 2009	86,700	86,700	123,806
FY 2010	93,700	93,700	107,000
FY 2011	6,500	6,500	7,236
Total, Construction	360,229	360,229	360,229
TEC			
FY 2004	20,379	0	0
FY 2005	24,701	45,080	4,000
FY 2006	71,837	71,837	51,506
FY 2007	31,000	31,000	72,763
FY 2008	111,600	111,600	80,106
FY 2009	86,700	86,700	123,806
FY 2010	93,700	93,700	107,000
FY 2011	6,500	6,500	7,236
Total, TEC	446,417	446,417	446,417

	(dollars in thousands)		
	Appropriations	Obligations	Costs
Other Project Cost (OPC)			
OPC except D&D			
FY 2004	37,500	37,500	37,500
FY 2005	2,842	2,842	2,842
FY 2006	4,561	4,561	4,561
FY 2007	12,611	12,611	12,611
FY 2008	3,343	3,343	3,343
FY 2009	9,640	9,640	4,156
FY 2010	19,902	19,902	21,150
FY 2011	34,077	34,077	47,313
Total, OPC except D&D	124,476	124,476	124,476
OPC			
FY 2004	37,500	37,500	37,500
FY 2005	2,842	2,842	2,842
FY 2006	4,561	4,561	4,561
FY 2007	12,611	12,611	12,611
FY 2008	3,343	3,343	3,343
FY 2009	9,640	9,640	4,156
FY 2010	19,902	19,902	21,150
FY 2011	34,077	34,077	47,313
Total, OPC	124,476	124,476	124,476
Total Project Cost (TPC)			
FY 2004	57,879	37,500	37,500
FY 2005	27,543	47,922	6,842
FY 2006	76,398	76,398	56,067
FY 2007	43,611	43,611	85,374
FY 2008	114,943	114,943	83,449
FY 2009	96,340	96,340	127,962
FY 2010	113,602	113,602	128,150
FY 2011	40,577	40,577	54,549
Total, TPC	570,893	570,893	570,893

Note (D&D): The "one-for-one" requirement is planned to be offset with D&D "banked excess".

General Note: $37,500,000 of pre-Critical Decision-0 costs for the Sodium Bearing Waste Treatment Facility is included in FY 2004 Other Project Costs (OPC).

Note (OPC and Construction): History updated based on actual costs through FY 2009.

6. Details of Project Cost Estimate

	(dollars in thousands) Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	86,188	86,188	86,188
Contingency	0	0	0
Total, PED	86,188	86,188	86,188
Construction			
Site Preparation	24,850	24,850	24,850
Equipment	94,887	94,887	94,887
Other Construction	200,533	200,533	115,383
Contingency	39,959(1)	30,900	34,500
Total, Construction	360,229	351,170	269,620
Total, TEC	446,417	437,358	355,808
Contingency, TEC	39,959(1)	30,900	34,500
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	37,500	37,500	37,500
Conceptual Design	44,330	44,330	56,865
Start-Up	30,505	30,505	6,935
Contingency	12,141(1)	21,200	4,500
Total, OPC except D&D	124,476	133,535	105,800
D&D			
D&D	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, OPC	124,476	133,535	105,800
Contingency, OPC	12,141(1)	21,200	4,500
Total, TPC	570,893	570,893	461,608
Total, Contingency	52,100(1)	52,100	39,000

General Note: Other Project Costs Other than D&D total includes contractor fee and $37,500,000 of pre Critical Decision-0 costs.
Note (D&D): The "one-for-one" requirement is planned to be offset with D&D "banked excess".

(1)- Total, Contingency includes $32,100K of management reserve for the project which is being controlled as DOE-held contingency.

7. Funding Profile History

($K)

Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Out-years	Total
FY 2004*	TEC	20,500	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	45,400	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	69,900	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2005	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2006*	TEC	291,310	13,200	0	0	0	0	0	0	304,510
	OPC	74,700	0	0	0	0	0	0	0	74,700
	TPC	366,010	13,200	0	0	0	0	0	0	379,210
FY 2007 Performance Baseline	TEC	281,147	23,033	0	0	0	0	0	0	304,180
	OPC	74,700	0	0	0	0	0	0	0	74,700
	TPC	355,847	23,033	0	0	0	0	0	0	378,880
FY 2008	TEC	335,317	8,391	0	0	0	0	0	0	343,708
	OPC	104,800	13,100	0	0	0	0	0	0	117,900
	TPC	440,117	21,491	0	0	0	0	0	0	461,608
FY 2009	TEC	346,391	9,417	0	0	0	0	0	0	355,808
	OPC	92,700	13,100	0	0	0	0	0	0	105,800
	TPC	439,091	22,517	0	0	0	0	0	0	461,608
FY 2010	TEC	346,217	83,700	7,441	0	0	0	0	0	437,358
	OPC	66,128	19,902	47,505	0	0	0	0	0	133,535
	TPC	412,345	103,602	54,946	0	0	0	0	0	570,893
FY 2011	TEC	346,217	93,700(1)	6,500(1)	0	0	0	0	0	446,417
	OPC	66,128	19,902	38,446(1)	0	0	0	0	0	124,476
	TPC	412,345	113,602	44,946	0	0	0	0	0	570,893

* For prior years both Conceptual Design and Project Engineering and Design are included.

(1) - The FY 2010 Budget included a $10,000K plus up in TEC which is offset by corresponding decreases to FY 2011 TEC and FY 2011 OPC.

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal year)	4Q FY2011
Expected Useful Life (number of years)	TBD
Expected Future Start of D&D (fiscal year)	TBD

(Related Funding requirements)

(Dollars in Thousands)

Annual Costs		Life Cycle Costs	
Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate

(Dollars in Thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	43,100	32,000	61,000	46,645
Maintenance	4,200	4,372	6,000	7,913
Total, Operations & Maintenance	47,300	36,372	67,000	54,558

General Note: The "one-for-one" requirement is planned to be offset with D&D "banked excess".

9. Required D&D Information

Area	Square Feet
Area of new construction	58,000
Area of existing facility(s) being replaced	TBD
Area of additional D&D space to meet the "one-for-one" requirement	TBD

General Note: The "one-for-one" requirement is planned to be offset with D&D "banked excess".

10. Acquisition Approach

Design and construction services will be obtained through the new Idaho Cleanup Project Contractor and that contractor will manage the overall design and construction effort and interfaces with the existing operating plant.

The project will be conducted in accordance with the project management requirements in DOE Order 413.3A, Program and Project Management for the Acquisition of Capital Assets.

Oak Ridge

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
East Tennessee Technology Park	208,938	118,200	225,100	230,489
Oak Ridge National Laboratory	129,125	229,910	83,300	108,102
Oak Ridge Reservation	95,513	80,000	41,868	30,334
Y-12 Plant	38,092	327,000	53,500	63,775
Total, Oak Ridge	471,668	755,110	403,768	432,700

Site Overview

The cleanup program mission in Oak Ridge will be complete when cleanup has safely reduced risks to the public, workers, and the environment at the East Tennessee Technology Park, Oak Ridge National Laboratory (Bethel Valley and Melton Valley watersheds), Y-12 National Security Complex, and Off-site Areas. These risks include potential exposure to contamination and industrial hazards resulting from decades of uranium enrichment, research, and nuclear weapons-related operations.

American Recovery and Reinvestment Act activities:

The Oak Ridge American Recovery and Reinvestment Act activities are funded at $558,110,000 for Defense, $78,800,000 for Non-Defense, and $118,200,000 for the Uranium Enrichment Decontamination and Decommissioning Fund, for a total of $755,110,000.

Specifically, this funding will provide the Oak Ridge National Laboratory and Y-12 sites the ability to accelerate demolition of high risk surplus contaminated facilities, and remediate the most significant source of mercury contamination to surface water, demolish surplus contaminated facilities and perform soil remediation. Under the American Recovery and Reinvestment Act, the Transuranic Waste Processing Center scope will include receipt, processing, and repackaging of contact-handled and remote-handled transuranic waste for subsequent disposal at an approved repository. Transuranic waste will be disposed of at the Waste Isolation Pilot Plant in Carlsbad, New Mexico. Low-level and mixed low-level originating from transuranic waste will be disposed at the Nevada Test Site or other approved disposal sites. Legacy transuranic waste disposition is expected to be accelerated by at least one year.

The following specific projects will take place at the Oak Ridge National Laboratory: Cap Bethel Valley Burial Grounds; Install Melton Valley Sentinel Wells; demolition and disposition of Buildings 3026 C&D; Oak Ridge National Laboratory Small Facilities demolition (11 facilities); and remove Tank W1A and remediate surrounding soils and Building 3038 Clean-Out. The following projects will take place at the Y-12 National Security Complex as follows: storm sewers in the West End Mercury Area; Y-12 Salvage Yard; Biology Complex (4 facilities); Building 9735; Building 9206 Filter House; and removal of legacy material from the Alpha-5 and Beta-4 buildings. In addition, work will include expansion of the Industrial Landfill V located at the Y-12 National Security Complex and the Environmental Management Waste Management Facility in order to provide necessary capacity for on-site waste disposal.

In addition, the American Recovery and Reinvestment Act Non-Defense funding will be used to complete legacy material removal and disposition from four buildings at Oak Ridge National Laboratory. The activities to be performed are part of the scope to cleanup the Oak Ridge National Laboratory but were not scheduled to begin until 2017; the soil remediation, waste cleanup, and building demolition to be performed under this project will now be complete by 2011 and represents a six year acceleration in the schedule. The ARRA activities include the following projects: demolition and disposition of facilities in the 2000 Complex, General Maintenance Facilities Complex, Southeast Lab Complex, and legacy material removal and disposition from four buildings in Central Campus Complex and Building 2026.

At the East Tennessee Technology Park, American Recovery Reinvestment Act funding will allow for the demolition of the K-33 former Gaseous Diffusion building and completion of some pre-demolition activities in the K-27 building.

Site Description

The Oak Ridge Reservation is in east Tennessee and is comprised of three facilities: the East Tennessee Technology Park; the Oak Ridge National Laboratory; and the Y-12 National Security Complex. In addition, there are some private properties that are not located on the Oak Ridge Reservation (the Atomic City Auto Parts Site and the David Witherspoon Sites) that are being cleaned up under the auspices of the Oak Ridge program.

Oak Ridge - East Tennessee Technology Park

The East Tennessee Technology Park site occupies approximately 5,000 administrative acres adjacent to the Clinch River and located approximately 13 miles west of Oak Ridge, Tennessee. Approximately 2,200 of these acres are to be addressed under the Comprehensive Environmental Response, Compensation, and Liability Act. It was originally built as a uranium enrichment facility for defense programs. The majority of the 125 major buildings on the site have been inactive since uranium enrichment production ceased in 1985.

Oak Ridge National Laboratory

Activities carried out at the 3,300-acre Oak Ridge National Laboratory historically have supported both the defense production operations and civilian energy research effort. Significant waste management activities took place within the Melton Valley area of the Laboratory. The Oak Ridge National Laboratory currently conducts applied and basic research in energy technologies and the physical and life sciences. Cleanup includes environmental remediation, decontamination, decommissioning and demolition of hazardous and radioactively contaminated facilities, and disposition of legacy low, mixed low-level, and transuranic waste.

Oak Ridge - Y-12National Security Complex

The Y-12 National Security Complex (Y-12) site is approximately 811 acres and is located about two miles southwest of Oak Ridge, Tennessee. Y-12 was originally a uranium processing facility and now dismantles nuclear weapons components, produces nuclear weapon secondaries, serves as one of the nation's storehouses for special nuclear materials, and reduces the global threat of weapons of mass destruction. The types of contamination found within the Y-12 site include radioactive, hazardous, and mixed wastes. The sanitary landfills for the entire Oak Ridge Reservation are located at Y-12. The Environmental Management Waste Management Facility (a Comprehensive Environmental Response, Compensation, and Liability Act disposal facility supporting the cleanup) is also located at Y-12.

Site Cleanup Strategy/Scope of Cleanup

The Oak Ridge cleanup strategy is a risk-based approach that focuses first on those contaminant sources that are the greatest contributors to risk. The overall strategy is based on surface and groundwater considerations, encompassing watersheds that feed the Clinch River and that are impacted by the DOE sites. Key Records of Decision have been signed for these watersheds. Final Records of Decision will be necessary for all watersheds to deal with the remaining ecological and groundwater concerns.

While risk reduction is the major cleanup driver, other factors that must be considered to achieve risk reduction are execution logic and mortgage reduction, which will ultimately reduce the cost and schedule to complete cleanup.

Site Completion (End State)

Planned completion of the East Tennessee Technology Park is scheduled no earlier than FY 2017. A significant number of additional contaminated facilities at the Oak Ridge National Laboratory and Y-12 are expected to be transferred to EM from the Office of Science and the National Nuclear Security Administration over the next few years. After cleanup is complete, the Oak Ridge National Laboratory will continue to operate as a world-class research facility and Y-12 will continue to operate, fulfilling its national security mission. The planned lifecycle completion date is 2021 to 2022.

Short-Term Projects:
Oak Ridge National Laboratory: The short-term scope at this site includes performing surveillance and maintenance of surplus facilities; operating waste treatment facilities; and conducting high-risk reduction cleanup projects

Bethel Valley at Oak Ridge National Laboratory: Specific high-risk reduction actions planned include preparing Building 3019 for U-233 downblending operations; excavation of Tank W-1A (Corehole 8) and associated transuranic soils; and remediating radiological and chemically contaminated soils and sediments.

Melton Valley at Oak Ridge National Laboratory: The Comprehensive Environmental Response, Compensation, and Liability Act remedial action project was completed in FY 2006. A significant amount of waste remains in situ. A final Record of Decision is required to address potential residual groundwater, sediment and ecological concerns within the watershed. In addition, pyrophoric material remains in one burial trench pending a decision with the regulators on any future remedial actions that may be required.

East Tennessee Technology Park: This project addresses decommissioning of facilities and remedial actions for contaminated sites at the former gaseous diffusion plant used to enrich uranium. Approximately 2,200 acres of the 5,000 administrative acres that comprise the East Tennessee Technology Park contain 167 known release sites that need to be remediated to mitigate contamination from plumes originated by contaminated soils and burial grounds from migrating off-site. In addition there are approximately 500 facilities, including 125 major buildings that require decommissioning and in most cases, demolition. The highest priority at the site is the decommissioning and decontamination of the K-25 and K-27 gaseous diffusion process buildings due to the deteriorating condition of the buildings affecting worker safety. A final Site-Wide Record of Decision is being prepared to address all groundwater, surface water, sediments, and ecological and long-term stewardship concerns at the site. Site closure will not occur earlier than FY 2017 and assumes the demolition of the K-25, K-27, K-31, and K-33 buildings.

Y-12: The short-term scope at this site includes performing surveillance and maintenance of surplus facilities; operating the on-site Environmental Management Waste Management Facility and sanitary landfills; and conducting high risk reduction cleanup projects at the Y-12 National Security Complex.

Offsite Areas: This project reduces risk and cleans up three privately owned properties that were contaminated due to the sale of contaminated materials from the DOE to private companies. DOE is responsible for the cleanup of these sites under the Tennessee Superfund law. The three sites are the Atomic City Auto Parts Site in Oak Ridge and the David Witherspoon, Inc. 901 and 1630 sites in Knoxville. The work at these sites has been completed and State approval of Records of Completion is pending. The state of Tennessee recently requested a re-verification survey of a one acre parcel adjacent to the 1630 site. The survey revealed the presence of minor radiological contamination. Future characterization is required to determine any necessary remedial actions.

Longer Term Projects:

Y-12: Surveillance and maintenance of surplus facilities and the operation of waste disposal facilities will continue at this site. A significant number of additional contaminated facilities at this site are expected to be transferred to EM from the National Nuclear Security Administration over the next several years as described in the Critical Decision 1 for the Integrated Facilities Disposition Program.

Oak Ridge National Laboratory: Surveillance and maintenance of surplus facilities, removal of Molten Salt Reactor Experiment fuel salts and the operation of waste treatment facilities will continue at this site. U-233 material stored in Building 3019 will be downblended and dispositioned. A significant number of additional contaminated legacy and demolished facilities at this site are expected to be transferred to EM from the Office of Science over the next several years as described in the Critical Decision 1 for the Integrated Facilities Disposition Program.

Long-Term Stewardship: The Comprehensive Environmental Response, Compensation, and Liability Act process will determine any necessary final actions for groundwater in the five watersheds subsequent to completion of the actions described above. Since most of the contaminated sites, media, and facilities left standing will not permit unrestricted use of the soil, groundwater, and surface water, extensive monitoring and long-term stewardship actions will be required.

Regulatory Framework

Cleanup of the Oak Ridge Reservation is primarily governed by three regulatory agreements/compliance orders. The first, the *Federal Facility Agreement for the Oak Ridge Reservation*, between DOE, the United States Environmental Protection Agency, and the Tennessee Department of Environment and Conservation implemented in (January 1992), establishes a procedure framework and schedule for developing, implementing, and monitoring appropriate site response actions under the Comprehensive Environmental Response, Compensation, and Liability Act.

The second, the *Oak Ridge Reservation Compliance Order*, between DOE and the Tennessee Department of Environment and Conservation (September 1995), enforces treatment of mixed low-level wastes under the Resource Conservation and Recovery Act. This order establishes milestones to complete treatment of all Oak Ridge mixed low-level wastes by 2012.

The third, the *Oak Ridge Reservation Polychlorinated Biphenyl Federal Facilities Compliance Agreement*, between DOE and the Environmental Protection Agency (October 1996), establishes a framework for treatment of polychlorinated biphenyl-contaminated wastes under the Toxic Substances Control Act.

Critical Site Uncertainties and Assumptions

Major uncertainties include: final agreement with the regulators on the extent of remediation to be accomplished under future Records of Decision; the reindustrialization of the decontaminated K-31 gaseous diffusion plant building at East Tennessee Technology Park which will eliminate the need for demolition; and the nature and amount of cleanup that will be required for the additional contaminated facilities that are expected to be transferred from the National Nuclear Security Administration (Y-12 site) and the Office of Science (Oak Ridge National Laboratory) to EM over the next few years.

Interdependencies

The success of the Oak Ridge Environmental Management Program requires effective project interfaces with the following:

National Nuclear Security Administration: Certain material recovered during the high risk equipment removal from the gaseous diffusion plant buildings at East Tennessee Technology Park will be shipped to Y-12 for storage.

United States Enrichment Corporation: United States Enrichment Corporation has a lease with DOE to access the K-1600 building at East Tennessee Technology Park and its centrifuge technology.

Office of Science: Close coordination with this office is critical to maintain the security posture for Building 3019 at the Oak Ridge National Laboratory.

Contract Synopsis

Oak Ridge Reservation currently utilizes three different prime contracts to implement its cleanup strategy: (1) Oak Ridge Environmental Management Cleanup Contract; (2) the Transuranic Waste Treatment Contract and (3) the U-233 Downblend Contract.

Oak Ridge Environmental Management Cleanup Contract: The Oak Ridge Closure Contract with Bechtel Jacobs Company, LLC was signed September 2003 with the singular focus of achieving specified milestones in the safest, most cost effective manner. This contract was restructured in 2008, as a cost-plus-fixed-fee contract with schedule incentives to focus efforts on the demolition of the K-25 Building. Planning efforts have started for the follow-on contract. Award is scheduled for 2011.

Transuranic Waste Treatment Contract: A privatization contract was signed with Foster Wheeler Environmental Corporation in August 1998 for the construction of a transuranic waste treatment facility and the treatment of remote-handled alpha low-level waste, and contact- and remote-handled transuranic waste. The original fixed-price contract with Foster Wheeler was converted to a cost-plus-fixed-fee contract in September 2006 and novated to EnergX, on January 15, 2008. The contract has been re-competed and awarded to a small business, Wastern Advantage Incorporated.

U-233 Downblend Contract: The contract for U-233 downblending and Building 3019 shutdown was awarded to Isotek Systems, LLC in October 2003, originally managed by the Office of Nuclear Energy Congress directed the Department in the FY 2006 Energy and Water Appropriations Act to transfer the management of this project to the Office of Environmental Management and to terminate the medical isotope production. The contract has been revised accordingly. Phase I covered planning and design, which was completed in July of 2007. The current contracting schedule is for enhanced 90% design, in which a detailed cost proposal will be provided with a revised baseline and data sheet.

Cleanup Benefits

Longer Term:

Closure of the East Tennessee Technology Park site is the next complex-wide opportunity for the EM Program to divest itself of a major liability. Remedial actions and decommissioning and decontamination of surplus facilities will be initiated at the Y-12 National Security Complex and Oak Ridge National Laboratory to reduce contamination which will protect on-site workers; mitigate off-site releases; and provide strategic real estate for modernization strategies.

Direct maintenance and repair at Oak Ridge is estimated to be $ 6,172,000.

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Oak Ridge			
Oak Ridge			
OR-0011Z / Downblend of U-233 in Building 3019	58,000	38,900	50,001
OR-0013B / Solid Waste Stabilization and Disposition-2012	88,183	35,615	23,925
OR-0031 / Soil and Water Remediation-Offsites	1,230	0	0
OR-0041 / Nuclear Facility D&D-Y-12	38,092	53,500	63,775
OR-0042 / Nuclear Facility D&D-Oak Ridge National Laboratory	71,125	44,400	58,101
OR-0043 / Nuclear Facility D&D-East Tennessee	105	100	87

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Technology Park (Defense)			
OR-0100 / Oak Ridge Reservation Community & Regulatory Support (Defense)	6,100	6,253	6,409
Subtotal, Oak Ridge	262,835	178,768	202,298
Uranium Enrichment Decontamination and Decommissioning Fund			
D&D Activities			
Oak Ridge			
OR-0040 / Nuclear Facility D&D-East Tennessee Technology Park (D&D Fund)	190,663	207,800	211,651
OR-0102 / East Tennessee Technology Park Contract/Post-Closure Liabilities/Administration	18,170	17,200	18,751
Subtotal, Oak Ridge	208,833	225,000	230,402
Total, Oak Ridge	471,668	403,768	432,700

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Oak Ridge					
Geographic Sites Eliminated (number of sites)	28	28	28	29	96.6%
Industrial Facility Completions (Number of Facilities)	329	351	368	635	58.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	116,914	117,949	120,566	181,682	66.4%
Nuclear Facility Completions (Number of Facilities)	8	8	8	25	32.0%
Radioactive Facility Completions (Number of Facilities)	26	28	28	76	36.8%
Remediation Complete (Number of Release Sites)	408	441	442	693	63.8%
Transuranic Waste shipped for disposal (Cubic meters) - CH	81	81	81	1,473	5.5%
Transuranic Waste shipped for disposal (Cubic meters) - RH	5	5	5	748	0.7%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OR-0011Z / Downblend of U-233 in Building 3019	**58,000**	**38,900**	**50,001**

This PBS is within the Defense Environmental Cleanup appropriation.

Oak Ridge maintains DOE inventory of Uranium-233 (U-233) currently stored in Building 3019 at the Oak Ridge National Laboratory. U-233 is a special nuclear material which requires strict safeguards and security controls to protect against access. The primary objectives of this project are to: 1) eliminate safety and nuclear criticality concerns; and 2) place the material for disposal. Treating the U-233 inventory as expeditiously as possible will reduce the substantial annual costs associated with safeguards and security requirements, which are funded by the Office of Science. Further, the risk of a nuclear criticality event will be eliminated as well as the need for future facility upgrades to Building 3019 to ensure safe storage of the inventory.

In addition, the Defense Nuclear Facilities Safety Board issued Recommendation 97-1, *Safe Storage of Uranium-233,* that identified concerns related to long-term storage of the inventory in Building 3019. The U-233 Project received approval of the performance baseline (Critical Decision 2) and limited construction/dismantling (Critical Decision 3A) on May 25, 2007. A datasheet for the operating expense-funded project is provided after the Explanation of Funding Changes.

In FY 2011, the following activities are planned:

- Maintain compliance with requirements at the appropriate waste disposal site for U-233, which requires Category 1 Security and compliance with10 Code of Federal Regulations 830 and 835.
- Complete the 90% Design for construction of annex and building 3019 modifications
- Complete dismantlement of Cell 1, Cell 2, Building 3136, and Building 3074 and to support the construction of the downblending process.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	0	100.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	0	100.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	96	96	96	1,426	7.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Finalize 60% design of U-233 down-blending equipment and Building 3019 modifications (FY 2009)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Continue Design for construction of annex and building 3019 modifications (September 2010)
- Continue surveillance and maintenance at U-233 to maintain a safe condition (September 2010/September 2011)
- Complete 90% Design for construction of annex and building 3019 modifications (September 2011)
- Obtain Critical Decision-3B from EM-1 to allow construction of the downblending process (September 2011)

	FY 2009	FY 2010	FY 2011
OR-0013B / Solid Waste Stabilization and Disposition-2012	**88,183**	**35,615**	**23,925**

This PBS is within the Defense Environmental Cleanup appropriation.

This project funds storage and Resource Conservation and Recovery Act closure, treatment and disposal of low-level, mixed low-level, hazardous, industrial, and sanitary waste from the East Tennessee Technology Park, Oak Ridge National Laboratory, and Polychlorinated Biphenyl Federal Facility Compliance Agreement mixed waste from Y-12. It also includes the operation of the Toxic Substances Control Act Incinerator and the Central Neutralization Facility. In addition, this project funds the management of the reservations of transuranic waste and the management of waste stored at East Tennessee Technology Park.

Contact-handled transuranic debris processing was initiated in FY 2006 and processing of remote-handled transuranic debris started in FY 2008 at the Transuranic Waste Processing Center. Processed waste is shipped to the Waste Isolation Pilot Plant or the Nevada Test Site for disposal.

In FY 2011, the following activities are planned:

- Manage and store mixed low-level waste in compliance with regulations.
- Continue to process, store and transfer remote-handled and contact-handled transuranic waste at the Transuranic Waste Processing Center.
- Maintain regulatory safety basis documents and permits for, and operate, waste storage facilities.
- Continue shipment of Polychlorinated biphenyls contaminated waste in accordance with the Federal Facility Compliance Agreement.
- A portion of the scope of work typically covered in this project is being executed with ARRA funding.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	81	81	81	1,449	6.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	5	5	5	550	1.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	12,921	13,607	15,897	29,614	54.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Manage and store mixed low-level waste in compliance with regulations. (FY 2009/FY 2009/September 2010/September 2011)
- Continue disposition of the East Tennessee Technology Park legacy Polychlorinated Biphenyl Federal Facility Compliance Agreement waste. (FY 2009/FY 2009/September 2010)
- Complete processing of 280 cubic meters of contact-handled waste (FY 2009)
- Toxic Substances Control Act Incinerator (September 2010)

	FY 2009	FY 2010	FY 2011
OR-0031 / Soil and Water Remediation-Offsites	**1,230**	**0**	**0**

This PBS is within the Defense Environmental Cleanup appropriation.

The properties, which cover 64 acres combined, are in residential and commercial areas and are accessible to the public. As of March 2009, remediation has been completed at the David Witherspoon, Inc. 901 site and the Atomic City Auto Parts Site. In addition, fieldwork is complete at the David Witherspoon, Inc. 1630 site. If associated paperwork is not complete in FY 2009, work will continue with the State in FY 2010 to achieve Records of Decision. The state of Tennessee recently requested a re-verification survey of a one acre parcel adjacent to the 1630 site. The survey revealed the presence of minor radiological contamination. Further characterization is required to determine any necessary remedial actions.

In FY 2011, the following activities are planned:

- No activities are planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	7	8	8	8	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete Field Work on David Witherspoon 1630 (FY 2009)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OR-0041 / Nuclear Facility D&D-Y-12	**38,092**	**53,500**	**63,775**

This PBS is within the Defense Environmental Cleanup appropriation.

This project funds the cleanup at the Y-12 National Security Complex, focusing on high-risk reduction projects in the near-term; cost-effective cleanup of the Oak Ridge Reservation through the construction and operation of the Environmental Management Waste Management Facility and the Oak Ridge Reservation Landfills; surveillance and maintenance of currently surplus facilities awaiting future decontamination and decommissioning; and groundwater and surface water monitoring to assess the effectiveness of completed cleanup actions and support future remediation decisions.

Located in a water-rich environment, Y-12 National Security Complex is a significant contributor of mercury, radionuclides, and volatile organic compounds, and polychlorinated biphenyls to the Upper East Fork of Poplar Creek (which flows through the City of Oak Ridge). In addition, Bear Creek Valley, which is located just west of the Y-12 plant, is the site of numerous liquid and solid waste disposal areas. To date, several high-risk reduction projects have been completed, including construction and operation of a water treatment system to reduce mercury contamination in surface water leaving the site, initial phases of remediation of the East End Volatile Organic Compound Plume to prevent further off-site migration of contaminated groundwater, and excavation of the Boneyard/Burnyard burial ground in Bear Creek Valley to reduce uranium contamination migration into surface water leaving the site. In FY 2009 and beyond, the remaining cleanup activities include demolition of contaminated EM facilities, additional sediment and soils removal to address mercury and polychlorinated biphenyls contamination and completion of the remaining records of Decision.

This PBS scope also includes incremental construction, operation, and final closure of the Environmental Management Waste Management Facility disposal facility. The facility currently has a capacity of 2.2 million cubic yards, with a final proposed build out capacity of 1.7 million cubic yards. A total of $14,000,000 in payments to a State of Tennessee trust fund will provide funding for the perpetual care of the Environmental Management Waste Management Facility after final closure. This project also includes the incremental construction and operation of the Oak Ridge Reservation Landfills for disposition of waste from all on-site DOE program offices. In addition, the coordination of surveillance and maintenance activities for the Y-12 National Security Complex, which include environmental monitoring of soils, sediments, surface water, and groundwater throughout the Oak Ridge Reservation, in order to effectively perform cleanup actions included in the PBS scope.

Additional scope has been identified that needs to be added to the Oak Ridge lifecycle cost and schedule to address Department environmental liabilities consisting of facilities, structures, and contaminated legacy areas excess to the Y-12 National Security Complex, including soils under facilities, groundwater, and surface water. Critical Decision-1 was approved on November 17, 2008.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011, the following activities are planned:

- Continue operations of Environmental Management Waste Management Facility and other Oak Ridge Reservation Landfills in accordance with Department of Energy Order requirements for groundwater and surface water monitoring, including Environmental Management Waste Management Facility waste acceptance criteria attainment activities.
- Continue surveillance and maintenance of waste sites, inactive facilities, and annual remediation effectiveness report for compliance with legal agreements between DOE, U.S. Environmental Protection Agency Region 4, the State of Tennessee, and environmental laws and regulations.
- Complete characterization of 81-10 Mercury Area.
- A portion of the scope of work typically covered in this project is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	0	0	0	43,038	0%
Industrial Facility Completions (Number of Facilities)	1	1	1	7	14.0%
Remediation Complete (Number of Release Sites)	28	28	28	138	20.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submit Water Resources Restoration Program RER to Regulators for Approval (March 2010/March 2011)
- Submit Environmental Management Waste Management Facility WAC Arraignment Capacity Assurance Report (CARAR) to the regulators for approval (April 2010/April 2011)
- Fund the Perpetual Care Fee for the Environmental Management Waste Management Facility (September 2010/September 2011)
- Continue operation of the Environmental Management Waste Management Facility to support EM cleanup (September 2010/September 2011)
- Continue management, surveillance, and maintenance of EM Facilities. (September 2010/September 2011)
- Continue operation of the Oak Ridge Reservation landfills to support Oak Ridge Operations (September 2010/September 2011)
- Submit Upper East Fork Poplar Creek Phase 1 record of decision for Source Control Actions amendment to the regulators (September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OR-0042 / Nuclear Facility D&D-Oak Ridge National Laboratory	**71,125**	**44,400**	**58,101**

This PBS is within the Defense Environmental Cleanup appropriation.

Areas requiring remediation include more than 50 inactive facilities (including six inactive research reactors), three significant plumes of contaminated groundwater, contaminated surface water, and numerous areas of soil and sediment contamination. These projects include excavation of highly contaminated sediments from surface impoundments located adjacent to White Oak Creek; and decontamination and decommissioning of high-priority facilities to ensure worker safety and mitigate the potential for contaminant release.

Additional scope has been identified that needs to be added to the Oak Ridge lifecycle cost and schedule to address Department environmental liabilities consisting of facilities, structures, outdated waste treatment facilities and contaminated legacy materials excess to the Oak Ridge National Laboratory, including soils under facilities, groundwater, and surface water. Critical Decision-1 was approved on November 17, 2008.

This project also includes surveillance and maintenance activities to maintain contaminated sites in accordance with safety basis documents until final decommissioning, decontamination and remedial actions are undertaken.

In FY 2011, the following activities are planned:

- Monitor groundwater and surface water in accordance with the Melton Valley and Bethel Valley Records of Decision.
- Perform surveillance and maintenance for Environmental Management inactive facilities and reactors at the Oak Ridge National Laboratory to maintain a safe and compliant condition.
- Maintain liquid, gaseous and process waste operations systems in support of the missions of the Office of Science and the Office of Environmental Management.
- Continue Acquisition Planning and Baseline development to support Critical Decision 2/3A for Integrated Facilities Disposition Program.
- Continue Data Quality Objective sessions and initiate soil characterization activities and soil excavation for Oak Ridge National laboratory Soils and Sediments Project
- Initiate fuel salt removal at Molten Salt Reactor Experiment.
- A portion of the scope of work typically covered in this project is being executed with ARRA funding.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	24	0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	198	0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	811	1,160	1,487	4,518	33.0%
Nuclear Facility Completions (Number of Facilities)	0	0	0	15	0%
Radioactive Facility Completions (Number of Facilities)	3	3	3	31	10.0%
Industrial Facility Completions (Number of Facilities)	7	7	7	28	25.0%
Remediation Complete (Number of Release Sites)	80	80	80	177	45.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Provide regulatory compliant operation of the Oak Ridge National Laboratory Process waste Collection/Transfer System (September 2010)
- Continue management, surveillance, and maintenance of EM Facilities. (September 2010/September 2011)
- Provide regulatory compliance operation of the Oak Ridge National Laboratory Process waste Collection/Transfer System (September 2011)
- Bethel Valley Soils and Sediments (September 2011)
- Molten Salt Reactor Experiment Fuel Salt Removal Activities (September 2011)

	FY 2009	FY 2010	FY 2011
OR-0043 / Nuclear Facility D&D-East Tennessee Technology Park (Defense)	**105**	**100**	**87**

This PBS is within the Defense Environmental Cleanup appropriation.

This project, in combination with PBS OR-0040, Nuclear Facility D&D East Tennessee Technology Park (Uranium Enrichment Decontamination and Decommissioning Fund) will accomplish the closure of East Tennessee Technology Park. This project funds decontamination, decommissioning, and demolition for the East Tennessee Technology Park facilities that were not involved in enriching uranium for commercial clients (per the Energy Policy Act of 1992).

This project also provides for the surveillance and maintenance required to maintain the facilities in accordance with safety basis documents while they await decontamination and decommissioning.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011, the following activities are planned:

- Perform surveillance and maintenance of the Centrifuge Facilities complex, to maintain in a safe and secure condition.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	32,979	32,979	32,979	32,979	100.0%
Radioactive Facility Completions (Number of Facilities)	0	0	0	0	100.0%
Industrial Facility Completions (Number of Facilities)	6	7	7	37	19.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue surveillance and maintenance on East Tennessee Technology Park defense facilities to ensure safety. (September 2010/September 2011)

	FY 2009	FY 2010	FY 2011
OR-0100 / Oak Ridge Reservation Community & Regulatory Support (Defense)	**6,100**	**6,253**	**6,409**

This PBS is within the Defense Environmental Cleanup appropriation.

This project funds two Tennessee non-regulatory Agreement-In-Principle grants, one Tennessee regulatory Federal Facility Agreement grant, and the activities of the Oak Ridge Site Specific Advisory Board. The first Agreement-In-Principle supports the Tennessee Department of Environment and Conservation's independent environmental oversight and monitoring of DOE activities taking place both on-site and off-site associated with the Oak Ridge Reservation. The second Agreement-In-Principle supports the Tennessee Emergency Management Agency in emergency response planning initiatives, including cooperative planning, conducting joint training exercises and developing public information regarding preparedness activities. The Federal Facility Agreement grant supports the Tennessee Department of Environment and Conservation, provides oversight of the requirements of the interagency agreement under the Comprehensive Environmental Response, Compensation, and Liability Act. The support for the Site Specific Advisory Board is chartered under the Federal Advisory Committee Act.

In FY 2011, the following activities are planned:

- Continue support to the State of Tennessee for conducting annual oversight, monitoring, and reporting. This includes: annual reports to the public; independent monitoring program of all environmental media; off reservation monitoring program of wells owned by private citizens adjacent to DOE land; establishment of background levels; DOE facility surveillance walkthroughs: Federal Facility Agreement activities; and emergency management exercises.

- Continue activities by the Site Specific Advisory Board sponsored by DOE-EM to assist in public participation activities.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue activities by the Site-Specific Advisory Board sponsored by DOE-EM to assist in public participation activities. (September 2010/September 2011)
- Provide financial support to the State of Tennessee for conducting annual oversight, monitoring, and reporting. (September 2010/September 2011)

OR-0040 / Nuclear Facility D&D-East Tennessee Technology Park (D&D Fund)	**190,663**	**207,800**	**211,651**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

This project funds decommissioning and decontamination of facilities and remedial actions for contaminated sites at the East Tennessee Technology Park. It also funds the site infrastructure services. Approximately 2,200 acres of the 5,000 administrative acres at the site contain potential contamination, including known groundwater contaminant plumes from former burial grounds and contaminated soils. This project includes approximately 167 release sites requiring remediation and 500 facilities (125 major buildings) requiring decommissioning and decontamination. The FY 2005 decommissioning of the K-29, 31 and 33 gaseous diffusion process buildings (covering 110 acres) completed the largest decommissioning project ever undertaken by DOE. The decommissioning and demolition of the K-25 gaseous diffusion process-building is the top priority because of worker safety concerns stemming from the continuing deteriorating condition of the building. The scope of the K-25 building subproject is to abate the hazardous materials, remove the process equipment and excess materials stored in the buildings, demolish the building structures, and appropriately characterize, package, transport and dispose of all the associated wastes. The decontamination and decommissioning of these other facilities include the planning, deactivation of utilities, asbestos and other hazardous material abatement, equipment dismantlement and disposal, structure demolition and waste disposal. Site infrastructure services include fire protection, utility services, environmental, safety, and health programs, real property management, power operations and maintenance, and capital improvements and repairs.

The end state of the site will be appropriate for non-federal industrial park for all areas of land down to a grade of ten feet below the surface.

In FY 2011, the following activities are planned:

- Maintain East Tennessee Technology Park in a safe and secure condition.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Continue demolition in preparation for demolition of the East Wing and North End of the K-25 Building.

- Begin demolition of K-33 to meet associated milestones with ARRA funding.

- Provide infrastructure support for decontamination and decommissioning and remedial action projects.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	5,178	5,178	5,178	5,178	100.0%
Nuclear Facility Completions (Number of Facilities)	2	2	2	4	50.0%
Radioactive Facility Completions (Number of Facilities)	8	10	10	30	33.0%
Industrial Facility Completions (Number of Facilities)	310	331	348	558	62.0%
Remediation Complete (Number of Release Sites)	103	122	123	167	74.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Declaration of criticality incredibility and readiness for demolition on K-25 process building (FY 2009)
- Complete Power House Area Soils Remediation (FY 2009)
- Predominately Uncontaminated Facilities Phase Construction Completion Report (October 2009)
- Submit the FY 2009 Earned Value Phase Construction Completion Report to the regulators (November 2009)
- Continue base operations activities at the East Tennessee Technology Park to provide infrastructure and support to the cleanup project. (September 2010/September 2011)
- Continue surveillance and maintenance on the East Tennessee Technology Park facilities including the K-25 and K-27 buildings to maintain a safe condition. (September 2010)
- Submit the FY 2010 Earned Value Phase Construction Completion Report to the Regulators (November 2010)
- Submit the East Tennessee Technology Park Sitewide Record-of-Decision TS report to the regulators (March 2011)
- Continue surveillance and maintenance on the East Tennessee Technology Park facilities to maintain a safe condition. (September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OR-0102 / East Tennessee Technology Park Contract/Post-Closure Liabilities/Administration	**18,170**	**17,200**	**18,751**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

This project funds on-going, long-term contractor obligations including post-retirement life and medical, long-term disability and pension benefits for pre-April 1998 retirees, who supported Oak Ridge enrichment facility programs.

In FY 2011, the following activities are planned:

- Continue funding of contractor liabilities associated with post-retirement life, medical benefits and pensions.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Continue support for Contractor Post Retirement Life and Medical and Pension (September 2011)					

	FY 2009	FY 2010	FY 2011
Total, Oak Ridge	**471,668**	**403,768**	**432,700**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Oak Ridge	
OR-0011Z / Downblend of U-233 in Building 3019	
▪ Increase funds scope of work to support construction activities of downblending process.	11,101
OR-0013B / Solid Waste Stabilization and Disposition-2012	
▪ Decrease reflects completion of RCRA closure activities at the Toxic Substances Control Act Incinerator.	-11,690
OR-0041 / Nuclear Facility D&D-Y-12	
▪ Increase supports expansion of risk reduction activities at the Y-12 Site.	10,275

	FY 2011 vs. FY 2010 ($000)
OR-0042 / Nuclear Facility D&D-Oak Ridge National Laboratory	
▪ Increase reflects funding to support the regulatory compliance operations for Federal Facility Agreement milestones.	13,701
OR-0043 / Nuclear Facility D&D-East Tennessee Technology Park (Defense)	
▪ No significant change.	-13
OR-0100 / Oak Ridge Reservation Community & Regulatory Support (Defense)	
▪ No significant change.	156
Uranium Enrichment Decontamination and Decommissioning Fund	
D&D Activities	
OR-0040 / Nuclear Facility D&D-East Tennessee Technology Park (D&D Fund)	
▪ Increase supports focus of D&D activities at the East Tennessee Technology Park on the K-25 Process Building.	3,851
OR-0102 / East Tennessee Technology Park Contract/Post-Closure Liabilities/Administration	
▪ Increase reflects additional costs associated with long-term contractor obligations.	1,551
Total, Oak Ridge	**28,932**

OR-0011Z Uranium-233 Down Blending and Disposition Project
Oak Ridge National Laboratory, Oak Ridge, Tennessee
Project Data Sheet is for Construction (Operating Expense Data Sheet)

1. Significant Changes

The most recent DOE O 413.3A approved Critical Decision (CD) is CD2/3A, approval of performance baseline and limited construction/dismantling, approved on May 25, 2007. The Total Project Cost is $240,821,000 (related operations and maintenance funding is $120,028,000 and DOE contingency is $23,972,000 for an approved baseline of $384,821,000).

A Federal Project Director with certification level III has been assigned to this project.

This Project Data Sheet is an update of the FY 2010 Project Data Sheet.

This Data Sheet is a resubmission of the FY 2010 data sheet. The ^{233}U project is currently in the design phase and is also maintaining the safe and secure operations of Building 3019. During a recent design review of the project (^{233}U), building 3019 was found to have structural integrity issues that prohibit its use for a portion of the processing. This resulted in the necessary addition of an Annex to facilitate the back end processing (drying). Also, it was recently discovered during the Waste Isolation Pilot Plant's (WIPP) Acceptable Knowledge Review, that a large percent of the ^{233}U inventory, the Consolidated Edison Uranium Solidification Project (CEUSP) material does not have sufficient Transuranic content for disposal at the Waste Isolation Pilot Plant (WIPP). This finding resulted in the need to revise the design to account for the presence of Resource Conservation and Recovery Act (RCRA) metals. This finding will require the waste to be disposed of at the Nevada Test Site (NTS) in lieu of the planned disposal at WIPP. Both of the discoveries listed above require significant design changes to the facility; however, these currently appear to decrease the construction and operational risk associated with the planned facility. The Department of Energy (DOE) plans to continue the design effort through 90% design before requesting a new baseline for construction and operations, in order to ensure that the construction estimate will have the accuracy necessary to complete the project on schedule and within budget. Following completion of 90% project design, DOE will make appropriate Congressional notifications. In the meantime, Project Engineering and Design (PED) costs have increased, and will continue to increase, based on additional design-related activities. Updates to the financial schedule will occur upon the completion of 90% project design.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1 (Design Start)	(Design/PED Complete)	CD-2	CD-3 (Construction Start	CD-4 (Project Complete)	D&D Start	D&D Complete
FY 2008	1Q FY 2006	1Q FY 2004	3Q FY 2009	4Q FY 2007	3Q FY 2009	3Q FY 2012		
FY2009	4Q FY03 (reconfirmed by EM 1Q FY 2007)	3Q FY04 (approved by EM 1Q FY 2007)		3Q FY 2007	3Q FY07 (CD-3A) 2Q FY09 (CD-3B)	4Q FY 2012 (CD-4A) 4Q FY 2015 (CD-4B)		

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete –Completion of D&D work

3. Baseline and Validation Status

(dollars in thousands)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC	
FY08	N/A	N/A	218,686	14,756	N/A	14,756	233,442	
FY09[a]	N/A	N/A	226,643	14,178	N/A	14,178	240 ,821	

4. Project Description, Justification, and Scope

The Defense Nuclear Facilities Safety Board (DNFSB) in a report to the Department of Energy (DOE) (DNFSB 97-1) has determined that the long-term storage of Uranium-233 (^{233}U) in Building 3019 at the Oak Ridge National Laboratory (ORNL) poses potential nuclear criticality accident and worker exposure concerns. The scope of this project addresses safeguards and security requirements, eliminates long-term worker safety and criticality concerns, and places the ^{233}U material in interim storage in preparation for future disposal. ^{233}U is a special nuclear material which requires extensive safeguard and security measures to protect against access. In addition, treating the ^{233}U inventory as quickly as possible would reduce the substantial annual costs associated with safeguards and security.

The Department developed a three-phased approach to allow for systematic decision-making and to increase the Department's flexibility. The base contract award consisted only of Phase I/Planning and Design. On October 9, 2003, a contract was awarded to Isotek Systems, LLC (Isotek), a limited-liability corporation formed by Duratek Federal Services, Inc., Nuclear Fuel Services, Inc., and Burns and Roe Enterprises, Inc., to perform Phase I of the work. Phase II/Project Implementation and Phase III/ Building 3019 Complex Shutdown are contract options that may be unilaterally exercised by the Department.

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[a] The costs of facility operations and facility shutdown ($120,028,000) are not included here; they are reported in Section 8 – Related Operations and Maintenance Funding Requirements. Also, DOE project contingency ($23,972,000) is not included in this estimate.

In FY 2006, this project transferred from the Office of Nuclear Energy to the Office of Environmental Management. In the Conference Report (109-275) accompanying the Energy and Water Development Appropriations Act for 2006, the conferees directed, "the Department to provide a report within 60 days of enactment of this Act that details the Department's path forward in managing this material." The Department delivered a report to Congress in February 2006 that discusses alternatives to safely disposition the Building 3019 inventory. After delivery of the report to Congress, DOE directed Isotek to begin a re-baselining effort to reflect the change in approach from long-term storage to final disposition of the material, address all material in the inventory, and to delete thorium extraction from the baseline. The baseline was further revised in FY 2007 to address newly identified safety concerns. Approval of Critical Decision 2/3A, performance baseline and limited construction/dismantling, for the U233 Disposition Project, Building 3019 was received on May 25, 2007. The approved baseline of $384,821,000 includes unfunded DOE contingency of $23,972,000 and related operations and maintenance funding requirements of $120,028,000

Phase I - Planning and Design:

Phase I consists of detailed project planning, process and facility modification designs, development of safety documentation, and development of detailed Phase II cost estimates. Phase I is being conducted on a cost-plus-fixed-fee basis.

The criteria used to determine whether to proceed with Phase II/Project Implementation and current status is provided below.

- The acceptability of the safety analysis, security plan, management plans and final design;
  Status - Redesign progressed under EM and was reviewed by an External Independent Review Team which validated that the project design and risks were adequately bounded by cost and schedule in November 2006. The team concluded that the design adequately supports the preliminary documented safety analysis. In addition, the requirement to receive a DOE approved Safety Evaluation Report prior to fabrication of long-lead procurement items ensures safety is integrated through construction. The Project management plans (e.g. Project Execution Plan and Risk Management Plan) have been updated to capture changes to the project scope and were approved as part of the CD-2/3A package. The project is operating under an approved Documented Safety Analysis and interim security plan.

- The acceptability of the detailed cost estimate to complete the project, as determined by an independent cost analysis ("should cost analysis") by DOE using the contractor's design and processing approach;
  Status - EM conducted an independent cost evaluation in preparation to proceed with Phases II and III of the project.
- The overall performance of the contractor in meeting the DOE cost, schedule, and safety requirements; and
  Status - The overall performance of the contractor is evaluated consistent with the terms of the contract. Cost and schedule progress are tracked and monitored through weekly progress meetings, review of

monthly progress reports, and the evaluation of contractor invoices. Contractor performance issues have been identified that may affect DOE's decision to proceed with the next phase of the contract. A detailed earned value system will be established consistent with DOE Order 413.3A now that EM has received CD-2 approval.

- The confirmation of existing National Environmental Policy Act (NEPA) documentation supporting the planned activities.

  Status – The Department prepared a revised Environmental Assessment to confirm adequate National Environmental Policy Act documentation for the project. The draft Environmental Assessment considered nine alternatives to the current preferred alternative. The draft was published in December 2006 and issued for public comment. After a 60 day comment period a final Environmental Assessment and Finding of No Significant Impact were published in March 2007.

Phase II - Project Implementation

During Phase II, the contractor will begin the necessary facility modifications and processing equipment installation. Total estimated cost and total project cost data reflect estimates for Phase I design costs and Phase II modifications to the Building 3019 Complex costs and are consistent with the validated baseline. Included in Phase II, the contractor would down-blend the enriched ^{233}U with depleted uranium, and transfer containers of down-blended material to an on-site storage facility. Execution of the project activities during Phase II would satisfy all of the project objectives including resolution of Defense Nuclear Facilities Safety Board Recommendation 97-1.

During Phase II, the contractor would also be responsible for operation of the Building 3019 Complex, including the characterization, packaging, transportation and disposal of secondary wastes (*e.g.*, personal protection equipment, construction debris, liquid residues, etc.)

During Phase II, the contractor is required to develop transition plans to place Building 3019 Complex in a safe and stable shutdown configuration and transfer to the DOE decommissioning program. The contractor would also be required to develop a post-transition surveillance and maintenance plan. These plans would ensure that any contamination present is adequately contained, and that potential hazards to workers, the public, and the environment are minimized and controlled.

Upon completion of Phase II/Project Implementation processing activities, the contractor would be required to purge all processing systems and equipment of residual process materials in accordance with criteria specified by DOE. After clean-up has been completed, the contractor would characterize these systems and equipment and provide the characterization data to DOE.

Phase III - Building 3019 Complex Shutdown

Phase III will consist of performance of facility stabilization to ready the facility for decommissioning. The estimated duration of Phase III is 6 months.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A and DOE M 413.3-1, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED			
Prior Years	22,694	22,694	19,852
FY06	17,821	17,821	11,530
FY07	13,706	13,706	14,388
FY08	0	0	8,304
FY 09	0	0	TBD
Total, PED	54,221	54,221	TBD
Construction			
FY07	21,794	21,794	0
FY08	30,000	30,000	36,963
FY09	57,500	57,500	TBD
FY10	37,400	37,400	TBD
FY11	46,992	46,992	TBD
FY12	52,847	52,847	TBD
Total, Construction	246,533	246,533	TBD
TEC			
Prior Years	22,694	22,694	19,852
FY06	17,821	17,821	11,530
FY07	35,500	35,500	14,388
FY08	30,000	30,000	45,267
FY09	57,500	57,500	TBD
FY10	37,400	37,400	TBD
FY11	46,992	46,992	TBD
FY12	52,847	52,847	TBD
Total, TEC	300,754	300,754	TBD
Other Project Cost (OPC)			
OPC except D&D			
FY09	500	500	TBD
FY10	1,500	1,500	TBD
FY11	3,008	3,008	TBD
FY12	9,170	9,170	TBD
Total, OPC except D&D	14,178	14,178	TBD
D&D			
FY	0	0	0
Total, D&D	0	0	0
Total OPC			
FY09	500	500	TBD
FY10	1,500	1,500	TBD
FY11	3,008	3,008	TBD
FY12	9,170	9,170	TBD

(dollars in thousands)

	Appropriations	Obligations	Costs
Total, OPC	14,178	14,178	TBD
Total Project Cost (TPC)			
FY05	22,694	22,694	19,852
FY06	17,821	17,821	11,530
FY07	35,500	35,500	14,388
FY08	30,000	30,000	45,267
FY09	58,000	58,000	TBD
FY10	38,900	38,900	TBD
FY11	50,001	50,001	TBD
FY12	62,017	62,017	TBD
Total, TPC[a]	314,932	314,932	TBD

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	53,880	NA	53,880
Mgt. Reserve	341	NA	341
Total, PED	54,221	NA	54,221
Construction			
Site Preparation	3,803	NA	3,803
Equipment	72,734	NA	72,734
Other Construction	72,253	NA	72,253
Mgt. Reserve	23,632	NA	23,632
Total, Construction	172,422	NA	172,422
Total, TEC	226,643	NA	226,643
Mgt. Reserve, TEC	23,973	NA	23,973
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	NA	NA	NA
Conceptual Design	NA	NA	NA
Start-Up	7,909	NA	7,909
Mgt. Reserve	6,269	NA	6,269
Total, OPC except D&D	14,178	NA	14,178
D&D			
D&D	NA	NA	NA

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[a] The costs of facility operations and facility shutdown ($120,028,000) are not included here; they are reported in Section 8 – Related Operations and Maintenance Funding Requirements. Also, DOE project contingency ($23,972,000) is not included in this estimate

	(dollars in thousands)		
	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Mgt. Reserve	NA	NA	NA
Total, D&D	NA	NA	NA
Total, OPC	14,178	NA	14,178
Mgt. Reserve, OPC	6,269	NA	6,269
Total, TPC	240,821	NA	240,821
Total, Mgt. Reserve	30,242	NA	30,242

7. Funding Profile History

($K)

Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Out-years	Total
FY 2004*	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2005	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2006*	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2007 Performance Baseline	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2008	TEC	123,305	25,600	17,200	3,485	0	0	0	21,470	191,060
	OPC	1,900	1,400	3,500	9,262	0	0	0	0	16,062
	TPC	125,205	27,000	20,700	12,747	0	0	0	21,470	207,122
FY 2009	TEC	163,242	37,400	25,092	909	0	0	0	0	226,643
	OPC	500	1,500	3,008	9,170	0	0	0	0	14,178
	TPC	163,742	38,900	28,100	10,079	0	0	0	0	240,821
FY 2010	TEC	163,515	37,400	25,092	636	0	0	0	0	226,643
	OPC	500	1,500	3,008	9,170	0	0	0	0	14,178
	TPC	164,015	38,900	28,100	9,806	0	0	0	0	240,821
FY 2011	TEC	163,515	37,400	46,992	52,847	0	0	0	0	300,754
	OPC	500	1,500	3,009	9,170	0	0	0	0	14,179
	TPC	164,015	38,900	50,001	62,017	0	0	0	0	314,933

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY12
Expected Useful Life (number of years)	8 yrs
Expected Future Start of D&D of this capital asset (fiscal quarter)	TBD

(Related Funding requirements)

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimatea	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Total Operations & Maintenance	See footnote 3	N/A	120,028	120,051

9. Required D&D Information

Area	Square Feet
Area of new construction	NA
Area of existing facility(s) being replaced	NA
Area of additional D&D space to meet the "one-for-one" requirement	NA

The existing facility is being converted to carry out this project's mission. The facility will be demolished under a separate project upon completion of the Uranium-233 Downblending and Disposition Project.

10. Acquisition Approach

The DOE Oak Ridge Office (ORO) is responsible for implementation of the ^{233}U project (including selection of principal contractor) and approval of specified procurement actions. Project deliverables are performed under a negotiated contract which was awarded on the basis of competitive bidding. A dedicated Federal Director at ORO oversees the efforts of the selected contractor, Isotek Systems, LLC. In addition, an Integrated Project Team, including members and support from Headquarters and potential receiver sites, has been established. An updated Acquisition Strategy for this project was approved by the Acquisition Executive on November 3, 2006.

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a Annual O&M (for down blending operations and facility shutdown) as follows: FY12 $23,494,000; FY13 $45,000,000; FY14 $44,600,000; FY15 $6,934,000.

Paducah

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Paducah Gaseous Diffusion Plant	161,751	78,800	163,937	136,504
Total, Paducah	161,751	78,800	163,937	136,504

Site Overview

For approximately 50 years, the Paducah Gaseous Diffusion Plant in Paducah, Kentucky supported the Federal Government and commercial nuclear power missions. Decades of nuclear energy and national security missions left radioactive and chemical contamination. The mission of the site is transitioning from primarily enrichment operations to shared missions with environmental cleanup, waste management, depleted uranium conversion, deactivation and decommissioning, and long-term stewardship.

The original mission at the Paducah Gaseous Diffusion Plant was to produce low-assay enriched uranium for use as commercial nuclear reactor fuel. In 1993, uranium enrichment operations were turned over to the United States Enrichment Corporation in accordance with the Energy Policy Act of 1992. Under the United States Enrichment Corporation, production of enriched uranium for use in the United States and abroad continues today. The United States Enrichment Corporation operates the enrichment program; however, the Department owns the physical plant and is responsible for the environmental remediation. The United States Enrichment Corporation is responsible for the operation and maintenance of all primary process and auxiliary facilities at Paducah.

It is assumed that the United States Enrichment Corporation will continue commercial gaseous diffusion operations beyond 2013.

Depleted Uranium Hexafluoride Conversion Facilities

Since the 1950s, the depleted uranium hexafluoride produced during enrichment operations at the Portsmouth and Paducah Gaseous Diffusion Plants (and the East Tennessee Technology Park in Tennessee) has been stored in large steel cylinders at the sites. DOE is responsible for the management of approximately 700,000 metric tons of depleted uranium hexafluoride stored in about 60,000 cylinders (~440,700 metric tons at Paducah). DOE has constructed a depleted uranium hexafluoride conversion facility at Paducah to convert the depleted uranium hexafluoride to a more stable form for reuse or disposal. DOE is ultimately responsible for the deactivation and decommissioning of the facilities.

The Department is committed to the cleanup of the Paducah Gaseous Diffusion Plant to industrial standards in the industrial area of the plant and to recreational standards for the rest of the site. Limited land areas will require institutional controls following remediation. Excess buildings at Paducah that are not being leased are being assessed for by the Department for demolition. Equipment and material removed from buildings will be decontaminated, reused, or recycled to the extent practicable.

American Recovery and Reinvestment Act Activities

The Paducah American Recovery and Reinvestment Act activities are funded at $78,800,000. Specifically, this funding will be used in the removal and disposal of large process equipment and demolition of surplus chemical processing facilities. This project will accelerate by five to 22 years a reduction in legacy contaminated areas and make significant progress in the disposition of contaminated materials and wastes.

American Recovery and Reinvestment Act funding will accelerate and complete the dismantlement and disposal of all major systems and large process equipment contained within the C-410 Uranium Hexafluoride Production Complex, and complete structural demolition of the entire C-410 Complex to slab (200,000 square feet). In addition, this funding will assist in accelerating and completing the dismantlement and disposal of all major systems and large process equipment contained within the C-340 Uranium Metal Production Complex; complete all preparatory activities to leave the C-340 Complex (C-340-A, C-340-B, and C-340-C process facilities) in a state of readiness for demolition; and complete structural demolition of two ancillary facilities (C-340-D and C-340-E) to slab (4,000 square feet).

The American Recovery and Reinvestment Act funding will also accelerate and complete the packaging and disposal of loose materials, dismantlement and disposal of all systems and smelter equipment contained within the C-746-A East End Smelter; and complete structural demolition of the entire Smelter facility to slab (21,000 square feet).

Site Description

The Paducah site, comprising approximately 3,400 acres, is located in rural western Kentucky, 15 miles west of Paducah, Kentucky, near the confluence of the Ohio and Mississippi rivers.

Site Cleanup Strategy/Scope of Cleanup

Historic operations at Paducah produced contaminated areas onsite and beyond site boundaries. Principal contaminants of concern include uranium (from enrichment processing), technetium, trichloroethylene, and polychlorinated biphenyls. Through spills and disposal operations, contaminants have entered groundwater aquifers, formed plumes, and in some cases have migrated offsite and contaminated private drinking water wells. Since its inception the Paducah site has generated, stored, and disposed of hazardous, non-hazardous, radioactive, polychlorinated biphenyls, transuranic, and mixed waste, as well as large quantities of scrap metal.

Site Completion (End State)

The overall environmental cleanup strategy at Paducah is based on taking near-term actions to control or eliminate ongoing sources of contamination along with continued investigation of other potential sources. DOE's plan includes completion milestones for groundwater sources in 2011(C-400); 2015 (southwest plum sources); soils in 2015, surface water in 2017, and burial grounds in 2019.

In addition, Paducah completed construction of the depleted uranium hexafluoride conversion facility at full capacity. DOE anticipates the depleted uranium hexafluoride conversion operations to continue for over twenty-five years. Including the known work scope for decontamination and decommissioning of the main gaseous diffusion plant facilities, the lifecycle planning estimate is 2040.

Regulatory Framework

In May 1994, the Paducah site was placed on the Environmental Protection Agency's National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The 1997 Federal Facility Agreement among the Department, the Commonwealth of Kentucky, and the Environmental Protection Agency-Region IV established the framework for cleanup at Paducah, instituted enforceable milestones, and coordinated site-specific cleanup requirements under the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act. The Department also achieved resolution of long-standing regulatory disputes through the Agreed Order with the Commonwealth of Kentucky.

The Environmental Protection Agency and the Kentucky Department for Environmental Protection are the principal regulatory agencies for Paducah's waste management operations. Requirements applicable to Paducah's waste management activities include provisions of the Resource Conservation and Recovery Act-Part B, Hazardous Waste Management Permits; the Toxic Substances Control Act regulations for polychlorinated biphenyl wastes; DOE Order 435.1-Radioactive Waste Management; the Commonwealth of Kentucky surface water discharge regulations and the Commonwealth of Kentucky solid and hazardous waste regulations.

Future use of the site will support ongoing and anticipated DOE missions, United States Enrichment Corporation enrichment operations, and other current users. Power distribution functions and facility utilization by the private sector at the site is not expected to substantially change until the United States Enrichment Corporation terminates enrichment operations. Support has been expressed for various forms of recreational and public use that are compatible with anticipated industrial and recreational uses of the reservation.

Critical Site Uncertainties and Assumptions

The Department does not have a clear regulatory agreement on polychlorinated biphenyl cleanup levels, which remains a long-term, end-state issue.

The final Comprehensive Environmental Response, Compensation and Liability Act action for the Paducah environmental remedial activities is ongoing. Until the Record of Decision is agreed upon, a high degree of project uncertainty exists.

Uncertainty with current planning assumptions introduces a significant uncertainty associated with the project lifecycle cost estimate. These assumptions include that no more than three burial grounds will require excavation, and that the other burial grounds will be capped and managed in situ. Although the current planning assumptions include long-term ground water plume remediation to drinking water standards, a high degree of project uncertainty exists in that primary source removal/treatment has not been completed.

Future decontamination and decommissioning costs will be subject to several significant uncertainties including the extent of final environmental contamination, regulatory frameworks (Resource Conservation and Recovery Act vs. Comprehensive Environmental Response, Compensation and Liability Act cleanup levels), disposal options, and stakeholder/regulator acceptance. Kentucky Pollutant Discharge Elimination System effluent limits on radionuclides (Permit issued 11/06) are held in abeyance pending issuance of a modified Kentucky Pollutant Discharge Elimination System Permit to reflect recent regulatory changes affecting radionuclide effluent limits.

Interdependencies

Paducah is dependent upon the Nevada Test Site and commercial waste disposal sites for low-level, and mixed low-level waste disposal.

Contract Synopsis

The Portsmouth/Paducah Project Office awarded remediation and infrastructure contracts for each site. This strategy provided the optimum potential for achieving accelerated performance of the remediation and infrastructure efforts. The infrastructure contract provides information technology, mail, site security planning, road and ground maintenance, janitorial, and real and personal property inventory and disposition services. The original award fee contract will be completed in March 2010, and a new contract is to be in place. The scope of the remediation contract at the Paducah site includes cleanup and closure of all inactive facilities not leased to the United States Enrichment Corporation, cleanup of soils, groundwater, landfills, storage yards, and the disposal of legacy waste (excluding the United States Enrichment Corporation leased units). The original cost-plus-incentive-fee contract will be completed in June 2010, and a new contract is to be in place. Deactivation and decommissioning of the diffusion plant process facilities is not part of the current remediation contract. Gaseous Diffusion Plant planning and transition activities are included as an option in both awards.

Cleanup Benefits

The intent of the Federal Government is to manage the site and its missions in an integrated manner. DOE retains overall responsibility for the site. Significant portions of the site are leased by the United States Enrichment Corporation under the provisions of a lease with DOE. Achievement of DOE responsibilities in environmental cleanup and legacy material disposition will reduce environmental health and safety risks.

Direct maintenance and repair at the Paducah Gaseous Diffusion Plant is estimated to be $4,283,000.

Funding Schedule by Activity

(dollars in thousands)	FY 2009	FY 2010	FY 2011
Non-Defense Environmental Cleanup			
Gaseous Diffusion Plants			
Paducah Gaseous Diffusion Plant			
PA-0011 / NM Stabilization and Disposition-Paducah Uranium Facilities Management	1,767	249	2,476
PA-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	43,538	47,242	50,014
Subtotal, Paducah Gaseous Diffusion Plant	45,305	47,491	52,490
Uranium Enrichment Decontamination and Decommissioning Fund			
D&D Activities			
Paducah Gaseous Diffusion Plant			
PA-0013 / Solid Waste Stabilization and Disposition	13,218	13,218	7,747
PA-0040 / Nuclear Facility D&D-Paducah	99,045	99,045	72,156
PA-0102 / Paducah Contract/Post-Closure Liabilities/Administration (D&D Fund)	1,536	1,536	1,531
PA-0103 / Paducah Community and Regulatory Support (D&D Fund)	2,647	2,647	2,580
Subtotal, Paducah Gaseous Diffusion Plant	116,446	116,446	84,014
Total, Paducah	161,751	163,937	136,504

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Paducah					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	7,750	457,750	1.7%
Enriched Uranium packaged for disposition (Number of Containers)	0	0	0	182	0%
Industrial Facility Completions (Number of Facilities)	17	17	19	172	11.1%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	19,150	19,896	20,642	26,608	77.6%
Nuclear Facility Completions (Number of Facilities)	0	0	0	19	0%
Radioactive Facility Completions (Number of Facilities)	2	2	3	22	13.6%
Remediation Complete (Number of Release Sites)	94	109	125	217	57.6%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
PA-0011 / NM Stabilization and Disposition-Paducah Uranium Facilities Management	**1,767**	**249**	**2,476**

This PBS is within the Non-Defense Environmental Cleanup appropriation.

This project scope includes surveillance and maintenance of inactive facilities, management of legacy polychlorinated biphenyl remediation activities, maintaining compliance with the Toxic Substances Control Act (40 CFR 761) and the Uranium Enrichment Toxic Substances Control Act Federal Facilities Compliance Agreement of 1992. It also supports DOE Orders and other applicable requirements and support to the Nuclear Regulatory Commission for the five-year report to Congress on environmental, safety, and health.

Currently, approximately 2,725 polychlorinated biphenyl spills have been cleaned up.

In FY 2011, the following activities are planned:

- Ensure safety and services continue regarding mission critical facilities and infrastructure.
- Inspect and maintain polychlorinated biphenyl collection and containment systems.
- Conduct cleanup, sampling and disposal of polychlorinated biphenyl spills.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Enriched Uranium packaged for disposition (Number of Containers)	0	0	0	182	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue field activities associated with the polychlorinated biphenyl collections and containment troughing system in the cascade buildings (C-331, C-333, C-335, and C-337) and the cleanup, sampling, and decontamination of polychlorinated biphenyl spills and leaks (FY 2009/September 2010/September 2011)
- Inspect and maintain the polychlorinated biphenyl collection and containment system. (FY 2009/September 2010/September 2011)

PA-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	**43,538**	**47,242**	**50,014**

This PBS is within the Non-Defense Environmental Cleanup appropriation.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Approximately 700,000 metric tons of depleted uranium hexafluoride are stored in 60,000 cylinders at the Paducah and Portsmouth Gaseous Diffusion Plant sites. This PBS scope includes design, permitting, building, and operating a depleted uranium hexafluoride conversion facility at the Paducah Gaseous Diffusion Plant site. The facility converts depleted uranium hexafluoride into a more stable form of depleted uranium oxide suitable for reuse or disposition. The depleted uranium oxide will be sent to a disposal facility, and the hydrogen fluoride co-products will be sold on the commercial market. The empty cylinders will be sent to disposal or reused.

This project also includes surveillance and maintenance of all cylinders during conversion of the existing stockpile which will take about 25 years. The conversion facility contractor assumed responsibility for maintenance and surveillance of all depleted uranium hexafluoride cylinders in FY 2005.

Construction of the facility was completed in December 2008. Testing and commissioning activities continue in FY 2011, with hot operations expected to commence in second quarter FY 2011.

In FY 2011, the following activities are planned:

- Complete the Operational Readiness Review; commence safe operation of the DUF6 Project Conversion facilities and disposition of the resultant uranium oxide and hydrofluoric acid.
- Package 7,750 metric tons of depleted uranium for disposition.
- Conduct cylinder surveillance and maintenance, to keep existing material in a safe, stable condition.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	7,750	457,750	2.0%
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Complete processing of approximately 18,000 metric tons of DUF6 material. (September 2011) ▪ Initiate operations of conversion facility (September 2011)					

PA-0013 / Solid Waste Stabilization and Disposition **13,218** **13,218** **7,747**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

This project scope includes activities related to maintaining compliance with the Resource Conservation and Recovery Act Permit, Site Treatment Plan, and the C-746-U Contained Landfill Permit. This project scope includes storage, treatment, and disposition of all legacy waste generated by activities at the Paducah Gaseous Diffusion Plant prior to 1993 and all newly-generated waste from waste storage, treatment, and disposal operations. Although the United States Enrichment Corporation handles its own waste treatment and disposal through DOE's lease agreement, DOE remains responsible for some waste streams which are generated by the United States Enrichment Corporations operation of the plant. DOE handles this waste as newly generated waste. The transuranic and mixed transuranic wastes are scheduled for disposition by 2016. This project scope also includes the operation of the onsite sanitary landfill (C-746-U) and its auxiliary buildings.

Currently, approximately 20,006 m^3 (cumulative) of low-level/mixed low-level legacy waste has been disposed of either on- or off-site. Most of the remaining legacy waste was sorted, repackaged and characterized prior to on- or off-site treatment and/or disposal at the C-746 U Landfill.

In FY 2011, the following activities are planned:

- Continue landfill operations and maintenance.
- Characterize, treat, and dispose of any newly generated newly-generated waste.
- Complete the design for construction of cells 6-11 for the C-746-U on-site sanitary landfill.
- Conduct surveillance and maintenance of the waste storage buildings.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	19,150	19,896	20,642	26,608	78.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Expand on-site landfill, resulting in five cells for non-hazardous waste disposal. (FY 2009)
- Dispose of 1,669 cubic meters of newly generated waste and legacy mixed waste. (FY 2009)
- Operate and maintain the C-746-U landfill and various on-site waste storage facilities (September 2010/September 2011)
- Dispose of 746 cubic meters of newly generated waste (September 2010)
- Complete design for construction of Cells 6 through 11 for C-746-U on-site sanitary landfill (September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Dispose of 76 cubic meters of newly generated waste. (September 2011)

	FY 2009	FY 2010	FY 2011
PA-0040 / Nuclear Facility D&D-Paducah	**99,045**	**99,045**	**72,156**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

This project scope includes environmental cleanup and risk reduction through focused response actions and surveillance and maintenance activities, including decontamination and decommissioning of inactive or excess facilities at the Paducah Gaseous Diffusion Plant. Decontamination and decommissioning of the Paducah Gaseous Diffusion Plant itself is not yet included in the project scope, but limited planning has begun for the return (from lease by the United States Enrichment Corporation) and transition to DOE for decontamination and decommissioning.

This plant is an actively operating uranium enrichment facility surrounded by a wildlife management area. Past environmental operations created on- and off-site groundwater contamination which migrated to residential water wells and contaminated surface water.

This project scope includes remediation of C-400, the largest single source of groundwater contamination; decontamination and decommissioning of inactive soil facilities; surface water hot-spot removal actions; soil remediation; and groundwater dissolve phase plume actions. There are 12 burial grounds containing a variety of radioactive and hazardous wastes, and several contaminated surplus facilities which must be decontaminated and decommissioned.

Currently, progress includes approval of the Remedial Investigation Work Plan and completed remedial investigation field work at the burial ground operable unit. Evaluation of the data is ongoing. For the waste disposal cell, a sighting document and a cost estimate of various alternatives and proposed disposal sites is undergoing review. The contractor has also proposed a regulatory strategy for moving forward.

The United States Enrichment Corporation continues to provide support for Government Furnished Services & Items. The infrastructure contractor continues to provide services such as road repair, mowing, building repairs, IT, real property and fleet management, janitorial services, records management, and other services as necessary within the scope of the contract.

In FY 2011, the following activities are planned:

- Complete demolition of the C-410 Complex to slab.
- Continue demolition of C-340 A/B/C Complex.

- Complete fieldwork and Remedial Action Completion Report for the removal of two inactive soil facilities (C-218, and C410B).

- Sign Record of Decision for remediation of Southwest Plume sources.
- Complete a site-wide walkover for the areas outside the plant security fence.

- Issue C-400 Remedial Action Completion Report.

- Issue the D1 Soils Removal Action Work Plan to the Regulators and begin Soils Removal Action Field Work.

- Continue pump-and-treat operations and environmental surveillance, monitoring, and reporting.

- Conduct management and infrastructure surveillance and maintenance.

- Demolish the C-410 Complex, C-340-D, C-340-E, and C-746-A East End Smelter. This portion of the scope of work typically covered in this project is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	0	0	0	19	0%
Radioactive Facility Completions (Number of Facilities)	2	2	3	22	14.0%
Industrial Facility Completions (Number of Facilities)	17	17	19	172	11.0%
Remediation Complete (Number of Release Sites)	93	108	124	216	57.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Disposition all remaining mixed low-level waste (except mixed transuranic wastes) (FY 2009)
- Submit D1 Removal Action Work Plan-Surface Water Operation Unit (On-Site) to US Environmental Protection Agency and Kentucky (FY 2009)
- Issue D1 Burial Grounds Feasibility Study Report to the Environmental Protection Agency and the Kentucky Department of Environmental Protection (September 2010)
- Submit the D1 D&D EE.CA for C-340 to US Environmental Protection Agency and the Commonwealth of Kentucky (September 2010)
- Issue On-Site Comprehensive Environmental Response, Compensation and Reliability Act (September 2010)
- Submit D1 Remedial Action Completion Report-Groundwater Operable Unit (C-400) to US Environmental Protection Agency and Kentucky (April

(dollars in thousands)

FY 2009	FY 2010	FY 2011

2011/September 2011)

- Submit D1 Remedial Design Work Plan for the Southwest Plume Sources (September 2011)
- Submit C-340 D1 Removal Action Work Plan for Disposition of Inactive Facilities (September 2011)
- Submit D1 Remedial Action Work Plan for Surface Water Operable Unit (September 2011)

	FY 2009	FY 2010	FY 2011
PA-0102 / Paducah Contract/Post-Closure Liabilities/Administration (D&D Fund)	**1,536**	**1,536**	**1,531**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund.

This project scope supports a contract liability to provide for record searches performed for DOE and the Department of Justice investigations/studies, pending litigation, Freedom of Information Act requests, and information requests from both state and Federal regulatory and elected officials.

In FY 2011, the following activities are planned:

- Provide support to DOE and Department of Justice for all investigations and litigation.
- Provide payment into the Paducah pension program to remain in compliance with the Employee Retirement Income Security Act and other applicable laws, and DOE O 350.1 requirements.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
PA-0103 / Paducah Community and Regulatory Support (D&D Fund)	**2,647**	**2,647**	**2,580**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund.

This project scope includes an Agreement-in-Principle grant to the Commonwealth of Kentucky to provide independent oversight of the environmental programs at the Paducah Gaseous Diffusion Plant. The Commonwealth of Kentucky uses the grant funds to provide independent surface water, groundwater, air and other environmental monitoring at Paducah. These funds are not used by the Commonwealth of Kentucky to provide regulatory oversight. This project scope also supports the Federal Facility Agreement regulatory grant with the Commonwealth of Kentucky which provides for the administrative support necessary to oversee the requirements of the interagency agreement under the Comprehensive Environmental Response, Compensation, and Liability Act. Additionally, this project

(dollars in thousands)

FY 2009	FY 2010	FY 2011

scope also supports the activities performed by the Paducah Citizens Advisory Board.

In FY 2011, the following activities are planned:

- Continue support to the Citizens Advisory Board to assist in the public participation activities required by the Comprehensive Environmental Response, Compensation, and Liability Act.
- Ensure requirements are met regarding the Paducah Agreements-in-Principle and regulatory grants.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Provide financial support to the State for all Federal Facility Agreement administrative activities, including review/approval of Comprehensive Environmental Response, Compensation, and Liability Act documents (FY 2009/September 2010/September 2011) ▪ Provide financial support to the Commonwealth of Kentucky as required by the Agreement-in-Principle (FY 2009/September 2010/September 2011)					

	FY 2009	FY 2010	FY 2011
Total, Paducah	**161,751**	**163,937**	**136,504**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Non-Defense Environmental Cleanup	
Gaseous Diffusion Plants	
Paducah Gaseous Diffusion Plant	
PA-0011 / NM Stabilization and Disposition-Paducah Uranium Facilities Management	
▪ Increase provides for inspections and cleanup of spills of polychlorinated biphenyl collection and containment systems.	2,227
PA-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	
▪ Increase provides for operations of the DUF6 Conversion Facility based on the current project estimate.	2,772

	FY 2011 vs. FY 2010 ($000)
Uranium Enrichment Decontamination and Decommissioning Fund	
D&D Activities	
PA-0013 / Solid Waste Stabilization and Disposition	
▪ Decrease in FY 2011 represents completion of more costly off-site legacy waste disposition.	-5,471
PA-0040 / Nuclear Facility D&D-Paducah	
▪ Decrease in FY 2011 reflects completion of construction and commissioning of C-400 Phase I and II and completion of enhanced groundwater plume monitoring system and optimization of Northwest plume pump-and-treat system.	-26,889
PA-0102 / Paducah Contract/Post-Closure Liabilities/Administration (D&D Fund)	
▪ No significant change.	-5
PA-0103 / Paducah Community and Regulatory Support (D&D Fund)	
▪ No significant change.	-67
Total, Paducah	**-27,433**

Portsmouth

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Portsmouth Gaseous Diffusion Plant	236,215	118,200	285,798	463,056
Total, Portsmouth	236,215	118,200	285,798	463,056

Site Overview

For approximately 50 years, the Portsmouth Gaseous Diffusion Plant in Piketon, Ohio, supported Federal Government and commercial nuclear power missions. The mission of the site has transitioned from enrichment operations to environmental cleanup, waste management, depleted uranium conversion, decontamination and decommissioning, re-industrialization, and long-term stewardship.

In 1993, uranium enrichment operations were turned over to the United States Enrichment Corporation in accordance with the Energy Policy Act of 1992. Uranium enrichment operations at Portsmouth were terminated in 2000. In 2005, the facilities were transitioned to cold shutdown. In FY 2007, the Department formally established the approach to implement decontamination and decommissioning and cleanup of the site. The decontamination and decommissioning contract is expected to be awarded in FY 2010. A number of other facilities at the site are no longer required by United States Enrichment Corporation and have been, or will be, returned to DOE for decontamination and decommissioning.

The Department is committed to clean up the Portsmouth site. The Department's decontamination and decommissioning cleanup responsibilities for the Gaseous Diffusion Plant facilities were specified in the Energy Policy Act of 1992. The Department is now working with the regulators and the local community to finalize the cleanup goals for the site.

Depleted Uranium Hexafluoride Conversion Facilities

Since the 1950s, the depleted uranium hexafluoride produced during enrichment operations at the Portsmouth and Paducah Gaseous Diffusion Plants (and the East Tennessee Technology Park in Tennessee) has been stored in large steel cylinders at the sites. DOE is responsible for the management of approximately 700,000 metric tons of depleted uranium hexafluoride stored in about 60,000 cylinders (~250,000 metric tons at Portsmouth). Construction of a depleted uranium hexafluoride conversion facility at Portsmouth to convert the depleted uranium to a more stable form for reuse or disposal was completed in FY 2008, with operations scheduled to begin in FY 2011. This facility will operate over the next two decades, and DOE is ultimately responsible for the decontamination and decommissioning of the facility.

American Recovery and Reinvestment Act Activities

The Portsmouth American Recovery and Reinvestment Act activities are funded at $118,200,000. Specifically, this funding will complete demolition of three surplus building complexes, initiate remediation of contaminated soil, and initiate disposition of excess uranium material. Demolition will also be completed for the X-533 Switchyard structures including associated contaminated soil, the X-633 Cooling Tower structures, and the X-760 Chemical Engineering Building including associated contaminated soils.

Over 65 acres of contaminated soil will be restored, resulting in removal of the highest contaminant concentration groundwater plume source on the Portsmouth site. This will also result in the prevention of further potential groundwater contamination. This scope will now be completed in 2011 instead of in 2030.

Site Description

The Portsmouth site is located approximately 75 miles south of Columbus, Ohio in the foothills of the Appalachian Mountains.

Site Cleanup Strategy/Scope of Cleanup

The Portsmouth site's use of recycled reactor fuel (or reactor returns) as feed material in the 1950's introduced fission products such as technetium, cesium, and strontium into the system, as well as small quantities of transuranics, primarily plutonium and neptunium. Spills and waste disposal during past operations also resulted in contamination from various industrial solvents (e.g. trichloroethylene), uranium, technetium, and metals. Groundwater contamination is limited to a shallow aquifer that is not used as a drinking water source. Although all direct discharges from DOE operations have been monitored through a National Pollutant Discharge Elimination System permit since the early years of plant operations, minor levels of contaminants have been detected in nearby stream sediments.

DOE has focused environmental cleanup on high-risk areas first. DOE has completed all initial assessments required under the Resource Conservation and Recovery Act and has remediated several hazardous and solid waste sites. DOE is currently working with state and federal regulators as the site transitions to decontamination and decommissioning. This includes remedial action completion of the formally deferred units as they are de-leased and returned to the Department from the United States Enrichment Corporation. Facility decontamination and decommissioning is anticipated to be cleaned up using the Comprehensive Environmental Response, Compensation, and Liability Act process and environmental media (soil and groundwater) remediated in accordance with the Resource Conservation and Recovery Act Consent Decree with the Ohio Environmental Protection Agency and Consent Order with the United States Environmental Protection Agency. In addition, DOE will process the depleted uranium hexafluoride cylinders into a more stable form, for reuse or disposal.

The United States Enrichment Corporation-leased facilities are presently being deactivated to minimize future surveillance and maintenance costs. The current strategy is to implement full-scale decontamination and decommissioning upon award of a new contract in FY 2010 and to complete the decontamination and decommissioning activities in an accelerated manner.

Site Completion (End State)

The DOE obligation for decontamination and decommissioning of the Portsmouth Gaseous Diffusion Plant is a requirement of the Energy Policy Act of 1992.

The current end state completion for environmental restoration coincides with that of decontamination and decommissioning and completion of the depleted uranium hexafluoride conversion operations. The primary objectives of the near-term cleanup program will be to continue operations of groundwater treatment facilities in support of installed remedies and continue disposition of excess uranium materials and remove stored low-level and mixed waste streams contaminated with hazardous or toxic chemicals. Portsmouth will also decontaminate and decommission inactive ancillary facilities and initiate process building equipment removal actions, hazardous material abatement and deactivation activities. In addition, Portsmouth will operate the depleted uranium hexafluoride conversion facility at full capacity. Current plans include the transfer of leased gaseous diffusion plant facilities to the Department for surveillance, maintenance, and deactivation in preparation for decontamination and decommissioning. DOE anticipates the depleted uranium hexafluoride conversion operations to continue for approximately twenty years (including decontamination and decommissioning of the facility).

Regulatory Framework

Oversight of cleanup activities at the Portsmouth site is the responsibility of the Ohio Environmental Protection Agency and the Environmental Protection Agency - Region V. The program is being conducted in accordance with a State of Ohio Consent Decree and an Environmental Protection Agency Administrative Consent Order. The Ohio Environmental Protection Agency is the lead agency responsible for day-to-day oversight.

The Portsmouth site is not on the Comprehensive Environmental Response, Compensation, and Liability Act National Priorities List, but undertakes cleanup in accordance with Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act requirements. To facilitate site investigations and final cleanup actions, the Portsmouth site was divided into four quadrants based on groundwater flow and surface water runoff. Each quadrant contains multiple solid waste management units. The regulatory framework for final decontamination and decommissioning is currently being discussed with regulators and is anticipated to be an integration of decontamination and decommissioning under Comprehensive Environmental Response, Compensation, and Liability Act with ongoing environmental media cleanup activities under Resource Conservation and Recovery Act (Consent Order and Consent Decree). Discussions with the state and federal regulators are currently ongoing with the objective of submitting a draft Record of Decision for waste disposition activities in FY 2011.

Critical Site Uncertainties and Assumptions

It is assumed that United States Enrichment Corporation will support the timely return of leased gaseous diffusion plant facilities to the Department for decontamination and decommissioning as documented in the December 2009 Cold Shutdown contract modification between the Department and United States Enrichment Corporation.

DOE is evaluating the regulatory transition from the Nuclear Regulatory Commission to the DOE. This will require additional regulatory coordination with the State of Ohio and the Environmental Protection Agency and public involvement in planning efforts.

Future decontamination and decommissioning costs will be dependent upon the extent of final environmental contamination, regulatory frameworks (Resource Conservation and Recovery Act vs. Comprehensive Environmental Response, Compensation, and Liability Act cleanup levels), disposal/recycling options for the decontamination and decommissioning materials waste, and stakeholder/regulator acceptance.

Interdependencies

Portsmouth is dependent upon the Nevada Test Site waste disposal facility and commercial waste disposal sites for low-level and mixed low-level waste disposal.

The Portsmouth decontamination and decommissioning plan is incorporating lessons learned from the ongoing East Tennessee Technology Park decontamination and decommissioning project and the completed Fernald cleanup project.

Contract Synopsis

The Portsmouth/Paducah Project Office awarded the infrastructure and remediation contracts in 2009 at the Portsmouth site. The contracts provide incentives for improving remediation and infrastructure activities. The infrastructure contract provides information technology, human resources, mail, site security planning, road and ground maintenance, janitorial, and real and personal property inventory and disposition services. The remediation contract scope includes cleanup and closure of all inactive facilities not leased to United States Enrichment Corporation; cleanup of soil, groundwater, landfills, and storage yards; and disposal of waste (excluding leased units). The current cost-plus-incentive fee contract is expected to be completed in April 2010, and a new contract is expected to be in place.

The main process buildings are currently leased by United States Enrichment Corporation who performs surveillance and maintenance under a contract with the Department. DOE issued a Request for Proposal in FY 2009 and will award the contract for decontamination and decommissioning work in FY 2010. DOE is pursuing a strategy to significantly accelerate the decontamination and decommissioning activities and achieve completion in an expeditious manner.

Cleanup Benefits

The intent of the Federal government is to manage the site and its missions in an integrated manner. DOE retains overall responsibility for the site. Significant portions of the site footprint are managed by United States Enrichment Corporation under the provisions of a lease with DOE. Achievement of DOE responsibilities for environmental cleanup and legacy material disposition will reduce environmental health and safety risks.

Direct maintenance and repair at the Portsmouth Project Office is estimated to be $3,823,000.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Non-Defense Environmental Cleanup			
Gaseous Diffusion Plants			
Portsmouth Gaseous Diffusion Plant			
PO-0011 / NM Stabilization and Disposition-Portsmouth Other Uranium Facilities Management	8,564	8,641	0
PO-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	27,427	44,753	46,974
Subtotal, Portsmouth Gaseous Diffusion Plant	35,991	53,394	46,974
Uranium Enrichment Decontamination and Decommissioning Fund			
D&D Activities			
Portsmouth Gaseous Diffusion Plant			
PO-0013 / Solid Waste Stabilization and Disposition	35,000	14,871	41,081
PO-0040 / Nuclear Facility D&D-Portsmouth	164,276	216,287	373,507
PO-0103 / Portsmouth Contract/Post-Closure Liabilities/Administration (D&D Fund)	635	614	773
PO-0104 / Portsmouth Community and Regulatory Support (D&D Fund)	313	632	721
Subtotal, Portsmouth Gaseous Diffusion Plant	200,224	232,404	416,082
Total, Portsmouth	236,215	285,798	463,056

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Portsmouth					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	9,800	252,800	3.9%
Industrial Facility Completions (Number of Facilities)	8	8	8	121	6.6%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	35,754	35,754	35,754	35,754	100.0%
Nuclear Facility Completions (Number of Facilities)	0	0	0	13	0%
Radioactive Facility Completions (Number of Facilities)	7	7	7	27	25.9%
Remediation Complete (Number of Release Sites)	150	150	150	151	99.3%

Detailed Justification

(dollars in thousands)

FY 2009	FY 2010	FY 2011

	FY 2009	FY 2010	FY 2011
PO-0011 / NM Stabilization and Disposition-Portsmouth Other Uranium Facilities Management	**8,564**	**8,641**	**0**

This PBS is within the Non-Defense Environmental Cleanup appropriation.

Final disposition of the highly enriched uranium will be completed in FY 2010.

In FY 2011, the following activities are planned:

- Project concluded.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Perform polychlorinated biphenyl activities in the process buildings to maintain compliance. (FY 2009/September 2010)
- Complete conversion and final processing of highly enriched uranium. (June 2010)
- Complete disposition activities associated with approximately 2,048 large LEU cylinders. (September 2010)

	FY 2009	FY 2010	FY 2011
PO-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	**27,427**	**44,753**	**46,974**

This PBS is within the Non-Defense Environmental Cleanup appropriation.

Approximately 700,000 metric tons of depleted uranium hexafluoride are stored in 60,000 cylinders (~250,000 metric tons at Portsmouth) at the Paducah and Portsmouth Gaseous Diffusion Plant sites. This PBS scope includes design, permitting, building, and operating a depleted uranium hexafluoride conversion facility at the Portsmouth Gaseous Diffusion Plant site. The facility converts depleted uranium hexafluoride into a more stable form of depleted uranium oxide suitable for reuse or disposition. The depleted uranium oxide will be sent to a disposal facility, and the hydrogen fluoride co-products will be sold on the commercial market. The empty cylinders will be sent to disposal or reused.

This project also includes surveillance and maintenance of all depleted uranium hexafluoride cylinders during conversion of the existing stockpile, which will take about 18 years.

Construction of the facility was completed in May 2008. Testing and commissioning activities continued into FY 2010, with hot operations expected to commence in the first quarter of FY 2011.

In FY 2011, the following activities are planned:

- Commence safe operation of the DUF6 Project Conversion facilities and disposition of the resultant uranium oxide and hydrofluoric acid.
- Package 9,800 metric tons of depleted uranium for disposition.
- Conduct cylinder surveillance and maintenance to keep existing material in a safe, stable, condition.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	9,800	252,800	4.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete systems testing. (September 2010)
- Complete integrated systems testing. (September 2010)
- Complete processing of approximately 9,800 metric tons of DUF6 material. (September 2011)

PO-0013 / Solid Waste Stabilization and Disposition **35,000** **14,871** **41,081**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund.

This project scope includes storage, characterization, treatment, and disposition of legacy waste generated by activities at the Portsmouth Gaseous Diffusion Plant. These activities will reduce risks and storage costs. The primary waste streams are low-level, mixed low-level, Toxic Substances Control Act low-level, hazardous, sanitary, and newly generated wastes. Disposal of legacy waste is critical to completing cleanup of the site.

In FY 2011, the following activities are planned:

- Characterize, treat, and dispose of any newly generated waste.
- Continue disposition of uranium materials, including surplus low enriched natural and depleted uranium, from Fernald, Hanford, and several universities no longer used in research programs and material generated during cascade operations stored at the Uranium Management Center.
- Initiate disposition of large low enriched uranium cylinders.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Maintain waste minimization and pollution prevention programs to reduce the generation, volume, toxicity, and release of multi-media waste to promote the use of non-hazardous materials.

- Disposition filter ash and oil-leak material and the inventory stored at the Uranium Management Center (Building X-744G) which has no economic value or identifiable reuse.

- A portion of the scope of work typically covered in this project is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	35,754	35,754	35,754	35,754	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submitted annual Toxic Substance Control Act/Federal Facility Compliance Agreement compliance report to US Environmental Protection Agency (FY 2009)
- Submit annual report for the Site Treatment Plan to the Ohio Environmental Protection Agency. (December 2009/December 2010/December 2011)
- Complete disposition of small cylinders. (September 2010)
- Complete Site Treatment Plan milestone for commercial stabilization. (March 2011)

PO-0040 / Nuclear Facility D&D-Portsmouth	**164,276**	**216,287**	**373,507**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

This project scope includes remedial actions due to contamination resulting from the plant's historical uranium enrichment operations, inactive facility decontamination and decommissioning, and surveillance and maintenance activities at the Portsmouth Gaseous Diffusion Plant. The Department will award decontamination and decommissioning contract in FY 2010. Groundwater, sediment, and soil contamination exists at the site. Contaminants of concern include radioactive technetium-99, polychlorinated biphenyls, trichloroethylene, and heavy metals. DOE will continue to operate active and passive groundwater treatment systems until regulatory cleanup levels are achieved. Corrective measures have been implemented at five groundwater plumes; one of the plumes is migrating off the southern reservation boundary onto private property. Additional remedial actions are being implemented to address off-site migration.

Currently, Quadrant I, III, and IV corrective actions have been completed in preparation for final remedial actions. All initial remedial investigations and corrective measures studies required under the applicable regulations and agreements have been completed. The Quadrant II Corrective Measure

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Study/Corrective Measure Implementation has been submitted to the Ohio Environmental Protection Agency. DOE is awaiting the issuance of a Quadrant II decision document by the Ohio Environmental Protection Agency.

In FY 2011, the following activities are planned.

- Initiate process building equipment removal actions, hazardous materials abatement and other deactivation activities.
- Begin increased level of deferred unit remediation activities (buildings for which RCRA facility investigation has been deferred) in accordance with the deferred unit strategy.
- Begin increased level of decontamination and decommissioning of gaseous diffusion plant ancillary facilities and systems.
- Disposition decontamination and decommissioning waste off-site (during an interim period until a decision regarding waste disposition, including a potential on-site waste disposal facility and metal recycling is made in consultation with regulators and stakeholders).
- Continue site-wide infrastructure surveillance and maintenance to maintain compliance.
- Begin increased level of small equipment removal, utility optimizations and hazardous material abatement actions within the gaseous diffusion plant operations buildings.
- A portion of the scope of work typically covered in this project is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	0	0	0	13	0%
Radioactive Facility Completions (Number of Facilities)	7	7	7	27	26.0%
Industrial Facility Completions (Number of Facilities)	8	8	8	121	7.0%
Remediation Complete (Number of Release Sites)	20	20	20	21	95.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submit Phase III Remedial Action Report for Remediation of X-701B Solid Waste Management Unit to the Ohio Environmental Protection Agency and the US Environmental Protection Agency. (FY 2009)
- Submit Monthly Technical Progress reports and Quarterly Progress reports to the Ohio Environmental Protection Agency. (FY 2009)

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Award decontamination and decommissioning and surveillance and maintenance contract. (June 2010)
- Continue D&D of gaseous diffusion plant ancillary facilities and systems. (September 2010)
- Transition to the decontamination and decommissioning and surveillance and maintenance contracts. (September 2010)
- Submit Final Certification Report for the remediation of the X-701B Solid Waste Management Unit to the Ohio Environmental Protection Agency and the US Environmental Protection Agency (December 2010)
- Initiate process building equipment removal actions and other deactivation activities. (September 2011)

	FY 2009	FY 2010	FY 2011
PO-0103 / Portsmouth Contract/Post-Closure Liabilities/Administration (D&D Fund)	**635**	**614**	**773**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund.

The scope of this project supports ongoing litigation expenses, record searches and defense of numerous legal claims filed by plaintiffs alleging damages from or relating to the Portsmouth Gaseous Diffusion Plant. Record searches support legal claims, DOE and Department of Justice investigations/studies, Freedom of Information Act requests, and requests from both state and Federal regulatory and elected officials. There is no clean end-state to these activities. DOE is required to defend itself against all current and future litigation.

In FY 2011, the following activities are planned:

- Continue to provide defense against legal claims filed against the Government and its contractors.
- Continue record searches in support of legal claims, DOE and Department of Justice investigations/studies, Freedom of Information Act requests, and requests from both state and Federal regulatory and elected officials.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue record searches in support of legal claims, DOE and Department of Justice investigations/studies, Freedom of Information Act requests, and requests from both State and Federal regulatory and elected officials. (FY 2009/September 2010/September 2011)
- Defend against legal claims filed against the Government's contractors. (FY 2009/September 2010/September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
PO-0104 / Portsmouth Community and Regulatory Support (D&D Fund)	**313**	**632**	**721**

This PBS is within the Uranium Enrichment Decontamination and Decommissioning Fund.

This project supports activities to promote active involvement with the state and local stakeholders in the EM planning and decision-making processes and provides the opportunity for meaningful involvement in managing the cleanup and closure of the site. This project scope includes Payments-In-Lieu-Of-Taxes for Ohio's Pike County.

In FY 2011, the following activities are planned:

- Continue to support oversight activities of the Ohio Environmental Protection Agency.
- Continue support for the designated Site Specific Advisory Board.
- Continue Payments-In-Lieu-Of-Taxes to Ohio's Pike County.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Support the Ohio Environmental Protection Agency grant to support activities associated with the Portsmouth Consent Decree oversight. (FY 2009/September 2010/September 2011)

	FY 2009	FY 2010	FY 2011
Total, Portsmouth	**236,215**	**285,798**	**463,056**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Non-Defense Environmental Cleanup	
Gaseous Diffusion Plants	
Portsmouth Gaseous Diffusion Plant	
PO-0011 / NM Stabilization and Disposition-Portsmouth Other Uranium Facilities Management	
▪ Decrease reflects the conclusion of the Highly Enriched Uranium Program activities.	-8,641
PO-0011X / NM Stabilization and Disposition-Depleted Uranium Hexafluoride Conversion	
▪ Increase provides for operations of the DUF6 Conversion Facility based on the current project estimate.	2,221
Uranium Enrichment Decontamination and Decommissioning Fund	
D&D Activities	
PO-0013 / Solid Waste Stabilization and Disposition	
▪ Increase funding provides for waste management and support for packaging, treatment, shipment and disposal of waste offsite from the Uranium Management Center.	26,210
PO-0040 / Nuclear Facility D&D-Portsmouth	
▪ Increase reflects additional funding to transition from the Cold Shutdown/Remediation work scopes to the federally mandated Decontamination and Decommissioning /Remedial Action work scopes. This funding supports an accelerated closure by providing an increased level of small equipment removal and hazardous material abatement actions within the gaseous diffusion plant operations buildings.	157,220
PO-0103 / Portsmouth Contract/Post-Closure Liabilities/Administration (D&D Fund)	
▪ No significant change.	159
PO-0104 / Portsmouth Community and Regulatory Support (D&D Fund)	
▪ No significant change.	89
Total, Portsmouth	**177,258**

Richland

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Hanford Site	958,111	1,634,500	975,792	952,968
Richland Operations Office	19,620	0	21,940	19,620
Total, Richland	977,731	1,634,500	997,732	972,588

Site Overview

The Richland Operations Office manages cleanup of the Hanford Site, with the exception of the work managed by the Office of River Protection and the Pacific Northwest National Laboratory (managed by the Office of Science, Pacific Northwest Site Office).

The Hanford Site was established during World War II to produce plutonium for the nation's nuclear weapons. The last reactor to be decommissioned was the N-Reactor, and its spent nuclear fuel, originally stored in the K-Basins, has since been relocated to dry storage on the Central Plateau (also known as the 200 Area). The Central Plateau (200 Area) is the location of the former processing facilities where special nuclear materials were recovered and converted into forms that could be shipped to other sites for weapons manufacture and assembly. Support facilities are located in the 1100 Area, most of which have been turned over to the local community. The Hanford mission is now primarily site cleanup and environmental restoration to protect the Columbia River. The cleanup is addressed in commitments in a 1989 consent agreement, known as the Tri-Party Agreement. Parties to the agreement include the DOE, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology.

American Recovery and Reinvestment Act Activities

The Hanford Site, Richland Operations Office American Recovery and Reinvestment Act activities are funded at $1,634,500,000. Specifically, this funding will be used to demolish nuclear and support facilities, remediate waste sites, remediate contaminated groundwater, and retrieve solid waste from burial grounds. Accelerated cleanup of facilities, waste sites, and groundwater along the Columbia River will take place to support shrinking the active area of cleanup at the 586-square-mile Hanford Site to 75 square miles or less by 2015, more than five years ahead of the current schedule. Also, waste retrieval from the burial grounds will be accelerated by at least six years. These projects will include complete deactivation of Building 234-5Z process areas and laboratory areas and make them ready for demolition.

The American Recovery and Reinvestment Act funding will be used to complete construction of the 200-ZP-1 Operable Unit groundwater pump-and-treat system; complete construction of the 100-D Area groundwater pump-and-treat system; install 265 wells and/or boreholes along the Columbia River and in the Central Plateau; and decommission 280 old wells and boreholes.

Demolition of 30 facilities and remediation of 23 Waste Sites will occur at the 100 K area and American Recovery and Reinvestment Act funds will be used to excavate and construct the Environmental Restoration and Disposal Facility Super Cells 9 and 10. The Environmental Restoration and Disposal Facility operations will support footprint reduction by accelerating waste site remediation and facility demolition. This work also includes equipment and facility upgrades as well as mission general support. Workscope funded within the American Recovery and Reinvestment Act subproject also includes Discovery (orphan) waste sites characterization and remediation.

The American Recovery and Reinvestment Act funding will support the activities leading to the remediation of 618-10 burial ground and support critical path activities in the River Corridor contract. The 618-10 workscope included in the American Recovery and Reinvestment Act funding provides for characterization of the burial grounds.

Site Description

Hanford Site - Richland Operations Office: As noted above, the Richland Operations Office manages the majority of the Hanford Site in southeastern Washington State. The 1,533 square kilometer (586 square mile) site contains the Central Plateau, the River Corridor, the Fast Flux Test Facility, and the 600 Area.

Central Plateau:

The central part of the site is known as the 200 Area or the Central Plateau. The 200 Area is the location of chemical processing facilities used to separate and recover plutonium for use in nuclear weapons and several other valuable isotopes. Past releases of radioactive and regulated chemical materials have contaminated Hanford's facilities, groundwater, soils, and environment. Over 625,000 cubic meters of solid waste were buried in Hanford site soils, while more than 1.7 trillion liters of liquid waste containing radioactive and chemical contamination were discharged to the ground. The 200 Area's current mission involves cleanup of radioactivity and chemical contamination in about 800 waste sites, and approximately 1,000 buildings and structures.

Much of the Hanford Site's existing infrastructure has its roots in the Manhattan project. Sufficient infrastructure will be maintained as the cleanup mission progresses. As the need for the infrastructure diminishes, these systems and components will be demolished, removed or placed in long-term stewardship. The Central Plateau contains the following areas:

- 200 East Area: The 200 East Area covers approximately 9.1 square kilometers (3.5 square miles). The area has two processing plants: B Plant and Plutonium Uranium Extraction Plant. B Plant was deactivated in 1998 and Plutonium Uranium Extraction Plant was shutdown in 1997. The Effluent Treatment Facility, the Treated Effluent Disposal Facility, the Waste Encapsulation and Storage Facility, and the Canister Storage Building used in waste management activities are located in this area. The Canister Storage Building and surrounding areas store spent nuclear fuel and include the necessary security controls, including facility upgrades for the balance of spent fuel consolidation to this location. Offices and infrastructure support facilities are also located in the 200 East Area.

- 200 West Area: The 200 West Area covers just under 13 square kilometers (5 square miles) and is located about 13 kilometers (8 miles) from the Columbia River and 40 kilometers (25 miles) from

Richland. The 200 West Area includes Central Waste Complex, Waste Receiving and Processing, Environmental Restoration and Disposal Facility and three processing plants: U Plant and S Plant have been shut down, and T Plant is now used as the site's decontamination facility.

River Corridor

The River Corridor includes the eight production reactors (100 Area) and associated facilities as well as the fuel fabrication, research and development facilities in the 300 Area located in north Richland. The following areas are located along the Columbia River in southeastern Washington State:

- 100 B & C Areas: B Reactor, the world's first full-scale nuclear reactor, was named a National Historic Landmark by the Department of the Interior in August 2008. Most of the soil contamination at 100-B has been remediated but there are several small waste sites that still require remediation. The C Reactor is adjacent to the B Reactor and has been placed in interim safe storage (cocooned) for up to 75 years reducing the time and money needed for regular surveillance and maintenance.

- 100 K-West & K-East Areas: K-West and K-East reactors were built in 1955 and were shut down in 1970 and 1971. Even though the reactors were shut down, their fuel storage basins remained in operation, providing storage for up to 2,100 metric tons of spent nuclear fuel. The highly radioactive spent nuclear fuel from the K Basins has now been retrieved, cleaned, packaged, and safely stored away from the Columbia River in the 200 Area. In addition, approximately 300 tons of highly radioactive debris has been removed from the K Basins and disposed. However, 29 cubic meters of radioactive sludge remain in K-West Basin that must be removed and treated. Demolition of the K-East Basin was completed in FY 2009 and waste site remedial activities are ongoing.

- 100 N Area: N Reactor operated from 1963 to 1987 when it was shut down for maintenance, refueling, and safety upgrades. The N Reactor has been deactivated and the Interim Safe Storage process was initiated in FY 2009. This area contains slightly more than 100 buildings of which 23 have been demolished.

- 100 D & DR Areas: D Reactor was one of the three original reactors built in World War II. The reactor next to it is known as DR, or the D Replacement. The D and DR Reactors have been placed into interim safe storage. Cleanup of high-priority liquid waste sites in the 100-D Area began in 1996 and remediation of the burial grounds started in 2008.

- 100 H Area: Construction of H Reactor began in March 1948 and began operations in 1949 and was shut down in 1965. H Reactor was placed into interim safe storage in October 2005 and remediation of the burial grounds started in 2008.

- 100 F Area: F Reactor went into production in February 1945 during World War II and was shut down in 1965. A majority of the 100-F Area soil site remediation was completed in December 2008 and all of the burial grounds have been remediated. The remaining waste sites will be completed by December 2012.

- 300 Area: The 300 Area's two main functions were production (or fabrication) of fuel for the reactors (performed in the north end of the area) and chemical research to improve the entire fuel fabrication and processing capability. Many laboratories in this area are undergoing cleanout, deactivation, and demolition. The 300 Area buildings that remain active include laboratories, technical shops, engineering offices, their support facilities and the 310 Treated Effluent Disposal Facility (water treatment facility) and the 340 Facility.

Fast Flux Test Facility

The Fast Flux Test Facility is located in the 400 Area of the Hanford Site. Construction planning began in 1965, during the height of commercial nuclear power building and experimentation. Final shut down of the facility took place in January 2001. The facility has been placed in low-cost surveillance and maintenance mode prior to initiating full-scale decommissioning activities.

600 Area

The 600 Area includes all of the Hanford Site not occupied by the 100, 200, 300, and 400 areas. The Eberhart/Fitzner Arid Lands Ecology Reserve and the Hanford Reach National Monument/Saddle Mountain National Wildlife Refuge, managed by the U.S. Fish and Wildlife, serve as a security buffer for the activities conducted in the 100 and 200 Areas. Also located in this area is Energy Northwest Power, which operates a nuclear power plant on leased land. The 600 Area also hosts utility corridors and remediation sites, such as 618-10 and 618-11 Burial Grounds.

Transfer to Non-Federal Entity

Hanford's 1100 Area served for half a century as the hub of the site's support services. On September 30, 1998, the 1100 Area, the 26 facilities within it, and the 16 southern-most miles of the Hanford Railroad were transferred by DOE to Richland's Port of Benton for use in regional economic development. Transfer of the 768-acre 1100 Area (about 3.6 square kilometers, or 1.4 square miles) pushed the Hanford Site border north by about a mile.

Site Cleanup Strategy/Scope of Cleanup

The primary focus for the Hanford Site is the safe storage, treatment, and disposal of Hanford's legacy wastes and environmental restoration. The cleanup strategy is a risk-based approach that focuses first on those contaminant sources that are the greatest contributors to risk. Risk to the public, workers, and environment will be reduced by removing or stabilizing contamination before it migrates to the Columbia River or the groundwater. This includes cleanup of facilities and waste sites in the 100, 200, 300, 400, and 600 Areas, as well as, retrieval of suspect transuranic waste for final disposition off-site. The final focus is the cleanup of the 200 Area Central Plateau with priority on the decontamination and decommissioning of the Plutonium Finishing Plant and completion of groundwater remediation. Safe and secure interim storage of special nuclear material and spent nuclear fuel will continue to be maintained.

Site Completion (End State)

The Federal government is expected to maintain ownership of most of the site once cleanup is complete. The lifecycle planning estimate is 2050 to 2062. To date, about 50 percent of Hanford Site lands have been cleaned up or transferred for alternate uses. The North Slope has been put under the management of other Federal and Washington State agencies, but remains under DOE ownership as a safety buffer zone and pristine habitat. In 1999, DOE completed an environmental impact statement for the Final

Comprehensive Land Use Plan. Final decisions on the level of cleanup to be performed on individual waste sites continue to be made through the Comprehensive Environmental Response, Compensation, and Liability Act and the Resource Conservation and Recovery Act decision processes.

- **K Basin Closure:** K Basins closure is the highest risk reduction project due to its proximity to the Columbia River. Significant risk reduction has been achieved through removal of 2,100 metric tons of spent nuclear fuel from K Basins, representing over 55 million curies of radioactivity (95 percent of the radioactivity in Hanford's River Corridor) from near the Columbia River. Additional risk reduction will be achieved by treating the remote-handled transuranic sludge and placing it in a form suitable for disposition at the Waste Isolation Pilot Plant. The schedule for sludge treatment and disposition is currently being developed.

- **River Corridor Closure Project:** The River Corridor Closure Project will remediate 761 contaminated waste sites (including 50 burial grounds); deactivate, decontaminate, decommission and demolish 379 facilities adjacent to the Columbia River; and place eight reactors into interim safe storage condition. Completion of the project is expected by the contract end date of 2015 or earlier. The work includes excavating and disposing of contaminated soil, backfilling with clean soil, constructing interim safe storage for the reactors, and demolishing the old reactor complexes and facilities in the 300 Area. The project has the goal of ensuring that the land is sufficiently clean to support land management by the Department of Interior. At that time, the footprint of active Hanford cleanup will be reduced from the present 586 square miles to about 75 square miles.

- **Transuranic Retrieval:** All contact-handled suspect transuranic waste in the low-level burial grounds will be retrieved by December 2017, with the expectation that about half will be disposed as transuranic waste and half as low-level and mixed low-level wastes. Retrieval of the remote-handled waste will be performed by 2018. Processing of transuranic waste for shipment to the Waste Isolation Pilot Plant will occur in the Waste Receiving and Processing facility and T Plant. Upon completion of this cleanup work, all retrievably stored waste will have been retrieved and transferred to a treatment, storage, and/or disposal facility. Newly generated transuranic waste activities will continue in support of the Hanford mission.

- **Groundwater Remediation:** This project includes remediation and monitoring of groundwater/vadose zone to address contamination by carbon tetrachloride, chromium, technetium, strontium, and uranium. The end-state and cleanup decisions for existing groundwater plumes are to be completed by December 2011. Final groundwater remediation systems will be constructed as final cleanup decisions are made. Completion of Groundwater remediation facilities construction is projected to be accomplished and the facilities operating by 2015.

- **Solid Waste Disposal:** About 70,000 cubic meters of mixed low-level waste will be treated to meet regulatory requirements and then disposed of on-site in the mixed waste trenches (i.e., Burial Ground 218-W-5, or Trenches 31 and 34) or the Environmental Restoration Disposal Facility. About 130,000 cubic meters of low-level waste will be disposed of on-site in the mixed waste trenches and the Environmental Restoration Disposal Facility. In addition, liquid waste will be treated through the Effluent Treatment Facility, the Liquid Effluent Retention Facility, and the Treated Effluent Disposal Facility. The liquid waste processed through these facilities will be disposed to the soil through Washington State permitted disposal systems. Hanford will continue to operate facilities for the disposal of low-level and mixed low-level waste from Hanford and off-site generators.

- **Plutonium Finishing Plant Project:** The project provides storage of special nuclear materials and maintains the facilities in a safe and secure manner until the completion of demolition. Upon removal of all special nuclear material and fuels, the security area will be eliminated and the Plutonium Finishing Plant complex will be demolished to slab-on-grade.

- **Central Plateau Cleanup:** Over 625,000 cubic meters of solid waste were buried in Hanford site soils, while more than 1.7 trillion liters of liquid waste containing radioactive and chemical contamination have been discharged to the ground. DOE will clean up radioactivity and chemical contamination in about 800 waste sites that have the potential to impact groundwater, and demolish approximately 900 facilities on the Central Plateau and South Hanford Industrial Area.

- **Fast Flux Test Facility:** DOE has completed major elements of deactivation, including reactor defueling, fuel washing, dry packaging, storage (in storage casks) of the mixed oxide fuel (367 reactor fuel assemblies), transfer of all sodium-bonded fuel to the Idaho National Laboratory (11 shipments), and the draining of 260,000 gallons of bulk sodium in plant systems, reactor vessel and fuel storage vessels. DOE's contractor has completed final deactivation to place the facilities into long-term surveillance and maintenance, which included disposition of polychlorinated biphenyl transformers, reconfiguring electrical systems for surveillance and maintenance, cutting and capping water lines.

Regulatory Framework

As noted earlier, the U. S. Department of Energy, the U. S. Environmental Protection Agency, and the State of Washington Department of Ecology signed a comprehensive cleanup and compliance agreement on May 15, 1989. The Hanford Federal Facility Agreement and Consent Order, or Tri-Party Agreement, is an agreement for achieving compliance with the Comprehensive Environmental Response, Compensation, and Liability Act remedial action provisions and with the Resource Conservation and Recovery Act treatment, storage, and disposal unit regulations and corrective action provisions. More specifically, the Tri-Party Agreement: 1) defines and ranks cleanup commitments; 2) establishes responsibilities; 3) provides a basis for budgeting; and 4) reflects a concerted goal of achieving full regulatory compliance and remediation with enforceable milestones in an aggressive manner. In August 2009, the three parties approved a change package for the Hanford Federal Facility Agreement and Consent Order. The following milestones are currently subject to potential renegotiation.

Tri-Party Agreement/Compliance Milestones:

Tri-Party Agreement significant milestones for Plutonium Finishing Plant Project
- M-083-00A, Plutonium Finishing Plant Facility Transition and Selected Disposition Activities by September 2016

Tri-Party Agreement significant milestones for Transuranic Retrieval
- M-091-40, Complete Retrieval of Contact-Handled Waste to be determined by M-091-45
- M-091-41A, Complete Retrieval of Non-Caisson Remote-Handled Waste by December 2014
- M-091-42, Complete Treatment or Certification of Contact Handled Transuranic Mixed Waste to be determined by M-091-45
- M-091-41B, Complete Retrieval of the 200A Caisson Remote-Handled Waste in 218-W-4B by December 2018

- M-091-45, The Parties Will Complete Negotiations and DOE Will Submit a Change Package for Interim Milestones to Replace All "To Be Determined" Dates in M-091-01, M-091-40, M-091-42, and M-091-43, by February 2010

Tri-Party Agreement significant milestones for River Corridor Closure Project
- M-016-00A, Complete All Interim Response Actions for the 100 Areas, with the exception of the 100 K Area, by December 2012
- M-093-22, Complete 105-KE Reactor Interim Safe Storage in Accordance with the remedial Design/Remedial Action Work Plan by July 2014
- M-094-00, Complete Disposition of 300 Area Surplus Facilities by September 2015
- M-016-69, Complete All Interim 300 Area Remedial Actions by September 2015

Tri-Party Agreement significant milestones for the Groundwater Remediation
- M-015-73, Submit Feasibility Study Report and Proposed Plan for the 200-PO-1 Operable Unit by December 2011
- M-015-00D, Complete the Remedial Investigation/Feasibility Study through the submittal of a proposed plan for all 100 and 300 area operable units by December 2012
- M-016-120, Complete groundwater treatment system for the Tc-99 plume at the S/SX Tank Farm within the 200-UP-01 Operable Unit by December 2011

Tri-Party Agreement significant milestones for the Central Plateau Cleanup
- M-015-00, Complete 200 Area Remedial Investigation/Feasibility Study Process for all Non-Tank Farm Operable Units by to be determined
- M-016-00, Complete Remedial Actions for all Non-Tank Farm Operable Units by September 2024

Critical Site Uncertainties and Assumptions

The Richland Operations Office is currently addressing a number of significant known uncertainties including:

- Availability of off-site disposal for spent fuel and high-level waste;

- The acceptance of cleanup levels in Records of Decision by regulators to support deletion of the Hanford Site from the National Priority List;

- Records of Decision for the Central Plateau that will define cleanup actions of Central Plateau waste sites;

- Unexpected contamination at some waste sites or facilities;

- The final disposition of the cesium and strontium capsules (including any needed treatment and re-packaging).

Interdependencies

Richland has identified the following near-term interdependencies needed for mission execution:

- Transuranic Waste Shipments: About 27,000 cubic meters of transuranic waste is to be processed and shipped to the Waste Isolation Pilot Plant from the Hanford Site.
- Department of Defense Naval Reactors: Over 200 defueled naval reactor compartments will be disposed of in a dedicated trench at the Hanford Site in the 200 Area.
- Approximately 2,100 metric tons of spent nuclear fuel currently in interim storage at the Hanford Site are awaiting off-site disposal.
- Approximately 1,936 cesium and strontium capsules currently in interim storage at the Hanford Site are awaiting off-site disposal.
- Remediation of Central Plateau waste sites will need to be coordinated with the Office of River Protection's tank farm and Waste Treatment and Immobilization Plant activities.
- Consolidation of special nuclear materials must be coordinated with sites presently storing materials, NNSA transportation assets, and the Savannah River Site.

Contract Synopsis

In June 2008, the Plateau Remediation Contract was awarded. This cleanup contract, managed through the Richland Operations Office, deals with the cleanup of the central portion of the Hanford Site, which once housed five chemical separations buildings and other facilities that separated and recovered plutonium and other materials for use in nuclear weapons.

The work managed by the Richland Operations Office is also executed through two other contract vehicles. The River Corridor Closure contract, a cost-plus-incentive-fee type contract awarded in June 2005, covers cleanup of the nuclear reactor sites and the industrial 300 Area along the Columbia River as well as facilities in the 400 Area and two burial grounds in the 600 Area. The cost-plus-incentive-fee type contract was implemented to increase efficiency and accelerate the schedule for cleanup. In May 2009, the third contract Mission Support Contract was awarded. This contract will provide cost-effective infrastructure and site services integral and necessary to accomplish the Hanford Site's environmental cleanup mission. The scope of the Mission Support Contract includes five primary functions: Safety, Security and Environment; Site Infrastructure and Utilities; Site Business Management; Information Resources/Content Management; and Portfolio Management.

Cleanup Benefits

Near Term

The legacy of Hanford's 40 years of nuclear weapons production for the nation's defense includes enormous quantities of spent nuclear fuel, leftover plutonium in various forms, buried waste, contaminated soil and groundwater, and contaminated buildings that must undergo cleanup and be torn down. Forty percent of the approximately one billion curies of human-made radioactivity that exist across the nuclear weapons complex reside at Hanford and must be dealt with to protect human health and the environment.

The cleanup momentum over the past several years has been and continues to be focused on completing cleanup along the Columbia River Corridor, which is expected to be complete by 2015, and transitioning the Central Plateau of the Hanford Site to a modern, protective waste management operation—driving down the risks to workers, the community, and the environment.

- Spent Nuclear Fuel (K Basins Closure) project completed and removed more than 55 million curies of radioactivity—more than 95 percent of the radioactivity in Hanford's River Corridor.
- Reactor Interim Safe Storage has been completed for five of the eight reactors to be placed in interim safe storage at Hanford.
- With the September 2007 decision to consolidate plutonium at the Savannah River Site, ninety-nine percent of the plutonium at the Plutonium Finishing Plant will be shipped off-site to eliminate risk (the remaining one percent will be dispositioned elsewhere) and allow the Plutonium Finishing Plant to be decontaminated and decommissioned.
- Risks associated with the radioactive fuel and liquid sodium coolant at the Fast Flux Test Facility will be reduced and the facility will be placed in long-term surveillance and maintenance.

Longer Term

- Complete Comprehensive Environmental Response, Compensation, and Liability Act Records of Decision for the Central Plateau and initiate remediation activities.
- Complete retrieval of contact-handled transuranic waste by December 2017 reducing the environmental risks in the 200 Area.
- Complete remedial actions in the 100 B/C, 100F, and 100H areas.
- Complete K Basins sludge treatment, demolition of the basins, and 100 K Area remediation.
- Complete conversion of KE, KW, and N reactors to interim safe storage—the last of the eight reactors to be placed in interim safe storage.
- Once remedial actions have been implemented per the Records of Decision, transition to Long-Term Stewardship.

Direct maintenance and repair estimate at the Richland Operations Office is $40,158,000.

Funding Schedule by Activity

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2012 Accelerated Completions and 2035 Accelerated Completions to newly created control points of Central Plateau Remediation and River Corridor and Other Cleanup Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The funding table below provides a non-comparable display of the PBSs between control points.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Hanford Site			
2012 Accelerated Completions			
RL-0041 / Nuclear Facility D&D-River Corridor Closure Project	238,337	327,955	0
RL-0011 / NM Stabilization and Disposition-PFP	113,483	86,700	0
RL-0012 / SNF Stabilization and Disposition	124,671	126,712	0
Subtotal, 2012 Accelerated Completions	476,491	541,367	0
2035 Accelerated Completions			
RL-0100 / Richland Community and Regulatory Support	19,620	21,940	0
RL-0040 / Nuclear Facility D&D-Remainder of Hanford - 2035	103,282	90,313	0
RL-0030 / Soil and Water Remediation-Groundwater/Vadose Zone - 2035	175,238	205,390	0
RL-0013C / Solid Waste Stabilization and Disposition-2035	192,345	131,070	0
Subtotal, 2035 Accelerated Completions	490,485	448,713	0
Central Plateau Remediation			
RL-0011 / NM Stabilization and Disposition-PFP	0	0	64,969
RL-0012 / SNF Stabilization and Disposition	0	0	94,016
RL-0030 / Soil and Water Remediation-Groundwater/Vadose Zone – 2035	0	0	129,629
RL-0013C / Solid Waste Stabilization and Disposition-2035	0	0	135,026
Subtotal, Central Plateau Remediation	0	0	423,640
River Corridor and Other Cleanup Operations			
RL-0100 / Richland Community and Regulatory Support	0	0	19,620
RL-0040 / Nuclear Facility D&D-Remainder of Hanford - 2035	0	0	139,641
RL-0041 / Nuclear Facility D&D-River Corridor Closure Project	0	0	386,028
Subtotal, River Corridor and Other Cleanup Operations	0	0	545,289
Total, Hanford Site	966,976	990,080	968,929
Non-Defense Environmental Cleanup			
Fast Flux Test Reactor Facility D&D			
RL-0042 / Nuclear Facility D&D-Fast Flux Test Facility Project	10,755	7,652	3,659
Total, Richland	977,731	997,732	972,588

The funding table below provides a comparable display of the PBSs between control points.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Hanford Site			
Central Plateau Remediation			
RL-0011 / NM Stabilization and Disposition-PFP	113,483	86,700	64,969
RL-0012 / SNF Stabilization and Disposition	124,671	126,712	94,016
RL-0030 / Soil and Water Remediation-Groundwater/Vadose Zone - 2035	175,238	205,390	129,629
RL-0013C / Solid Waste Stabilization and Disposition - 2035	192,345	131,070	135,026
Subtotal, Central Plateau Remediation	605,737	549,872	423,640
River Corridor and Other Cleanup Operations			
RL-0100 / Richland Community and Regulatory Support	19,620	21,940	19,620
RL-0040 / Nuclear Facility D&D-Remainder of Hanford - 2035	103,282	90,313	139,641
RL-0041 / Nuclear Facility D&D-River Corridor Closure Project	238,337	327,955	386,028
Subtotal, River Corridor and Other Cleanup Operations	361,239	440,208	545,289
Total, Hanford Site	966,976	990,080	968,929
Non-Defense Environmental Cleanup			
Fast Flux Test Reactor Facility D&D			
RL-0042 / Nuclear Facility D&D-Fast Flux Test Facility Project	10,755	7,652	3,659
Total, Richland	977,731	997,732	972,588

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Richland					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	3,100	3,100	3,100	3,100	100.0%
Enriched Uranium packaged for disposition (Number of Containers)	2,958	2,958	2,958	2,958	100.0%
Industrial Facility Completions (Number of Facilities)	376	388	431	1,069	40.3%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	48,572	48,572	48,572	51,450	94.4%
Material Access Areas eliminated (Number of Material Access Areas)	16	20	20	20	100.0%
Nuclear Facility Completions (Number of Facilities)	28	32	34	82	41.5%
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	2,275	2,275	2,275	2,275	100.0%

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	3,437	3,437	3,437	3,437	100.0%
Radioactive Facility Completions (Number of Facilities)	52	55	72	346	20.8%
Remediation Complete (Number of Release Sites)	479	498	558	1,702	32.8%
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	2,124	2,124	2,124	2,124	100.0%
Transuranic Waste shipped for disposal (Cubic meters) - CH	3,030	3,030	3,030	24,580	12.3%
Transuranic Waste shipped for disposal (Cubic meters) – RH	0	0	0	858	0%

Detailed Justification

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2012 Accelerated Completions and 2035 Accelerated Completions to newly created control points of Central Plateau Remediation and River Corridor and Other Cleanup Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The Detailed Justification Table below has been comparably adjusted to reflect the PBSs within the new control points in order to aid in the review process.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RL-0011 / NM Stabilization and Disposition-PFP	**113,483**	**86,700**	**64,969**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The Plutonium Finishing Plant complex consists of several buildings that were used for defense production of plutonium nitrates, oxides and metal from 1950 through early 1989. The bulk of the plutonium bearing materials at the Plutonium Finishing Plant were stored in vaults. This PBS implements actions to package and ship special nuclear materials and fuels to long-term storage facilities; cleanout facilities and demolish them to slab-on-grade; and transition the below grade structures to PBS RL-0040, Nuclear Facility Decontamination and Decommissioning - Remainder of Hanford. These actions can be grouped in the following key categories: 1) stabilization, packaging, and shipment of the special nuclear materials and residues from the Plutonium Finishing Plant complex; 2) interim storage of special nuclear materials; 3) maintaining the facilities in a safe and secure manner until the completion of demolition; and 4) cleanout and demolition of facilities.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

As of September 2009, the Plutonium Finishing Plant Closure Project has completed stabilization and packaging of plutonium-bearing material into DOE-STD-3013 containers for shipment to an offsite storage location; completed repackaging and transfer of over 3,400 kilograms of bulk plutonium residue out of the Plutonium Finishing Plant protected area for shipment to the Savannah River site (authorization to ship was received on September 5, 2007); completed 100 percent of 'legacy' plutonium holdup (residual in hot cells) which is required for decommissioning and decontamination to proceed; and demolished 21 facilities.

The end-state for this PBS is dismantlement of the nuclear facilities in the Plutonium Finishing Plant complex to slab-on-grade.

In FY 2011, the following activities are planned:

- Support safe and essential services for over forty radiological and nuclear Plutonium Finishing Plant facilities and systems, and surveillance of residual radioactive and chemical contamination to ensure safe and compliant conditions.
- Provide for program management and support activities necessary for safe operations and essential services.
- Provide for site-wide services for day-to-day operations of general utilities, fire department, and analytical services.
- A portion of the scope of work typically covered in this PBS is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	2,275	2,275	2,275	2,275	100 0%
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	3,437	3,437	3,437	3,437	100.0%
Material Access Areas eliminated (Number of Material Access Areas)	16	20	20	20	50.0%
Nuclear Facility Completions (Number of Facilities)	21	21	23	31	68.0%
Radioactive Facility Completions (Number of Facilities)	0	0	1	26	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Initiated decontamination & decommissioning and removal of the Remote Mechanical A line and Building 234-5Z Balance of Plant (December 2008)
- Continue shipment of plutonium off-site (September 2009)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Complete de-inventory 3013 containers. (September 2009)
- Completed de-inventory of the slightly irradiated fuel (December 2009)
- Complete Protected Area Closure activities (January 2010)
- Complete transition (cold & dark) of 2736-Z/ZB complex (December 2010)
- Complete Pencil Tank removal from PRF (September 2011)

	FY 2009	FY 2010	FY 2011
RL-0012 / SNF Stabilization and Disposition	**124,671**	**126,712**	**94,016**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project supports Richland's mission for accelerated clean up of the River Corridor through stabilization, removal, and off-shipment of nuclear materials including spent nuclear fuel, radioactively contaminated sludge, water and debris from the K Basins. This PBS also supports basin removal and transition of the 100 K Area facilities and remaining waste sites to the River Corridor Contractor. The scope of this project encompasses the removal, packaging, and transportation of approximately 2,100 metric tons of degrading spent nuclear fuel from wet storage in the K Basins (K-East and K-West) near the Columbia River to a safe, dry interim storage on the 200 Area Central Plateau. Additionally, an estimated 29 cubic meters of radioactively contaminated sludge that currently resides in the basins will be removed from the basins and treated as remote-handled transuranic waste into its final disposal form, ready for permanent disposal off the Hanford site.

As of September 2009, all spent nuclear fuel and sludge has been removed from the K-East Basin; completed K-East Basin deactivation, decommissioning, decontamination and demolition; and completed containerization of K-West residual sludge from the final pass vacuuming.

The end-state of this PBS is the removal of all spent nuclear fuel from the K Basins, subsequent repackaging, drying and transportation to the Canister Storage Building for interim storage, removal of radioactively contaminated sludge from the K Basins, and removal and shipment of radioactively contaminated K Basin water to the 200 Area for treatment and disposal. All 100 Area K-East and K-West facilities will be transitioned to the River Corridor Contractor for final disposition. This end state represents significant risk reduction the basins posed to the Columbia River. With completion of the removal of 2,100 metric tons of spent nuclear fuel, more than 55 million curies of radioactivity (more than 95 percent of the radioactivity in Hanford's River Corridor) has been moved away from the Columbia River. Additional risk reduction has also been accomplished through the removal of significant debris from the basins. Further risk reductions are anticipated through removal of contaminated basin water, the basins themselves, and treatment of various sludge streams remaining in the K-West Basin.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011, the following activities are planned:

- Provide for site-wide services of day-to-day operations of general utilities, fire department, and analytical services.
- Operate and maintain K-West Basin and associated structures in a safe and compliant manner. Also, support required surveillance and maintenance activities.
- Procure Multiple Canister Overpacks, Sludge Treatment Storage Containers, and Knock-Out Pot Disposition.
- Continue sludge activities including analysis of engineered container and settler tube sludge samples, perform facility and system modification to process Knock-Out Pot material as spent nuclear fuel, initiate processing of Knock-Out Pot as fuel, and test the system required to transfer KW Basin sludge to the Central Plateau.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	2,117	2,117	2,117	2,117	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Completed decontamination & decommissioning of K East Basin (September 2009)
- Continue K West Basin safe and compliant and fuel processing capabilities (September 2010)
- Completion of laboratory analysis on engineered containers and settler tube sludge (September 2011)

RL-0013C / Solid Waste Stabilization and Disposition-2035 **192,345** **131,070** **135,026**

This PBS can be found within the Defense Environmental Cleanup appropriation.

Scope of this PBS includes storage of spent nuclear fuel, transuranic waste, mixed low-level waste, and low-level waste generated at the Hanford Site and other DOE and Department of Defense facilities. The transfer of spent nuclear fuel elements to the Canister Storage Building is complete for this PBS.

This PBS includes packaging of EM legacy and non-legacy spent nuclear fuel and storage in the Canister Storage Building or 200 Area Interim Storage Area. This PBS also includes wet storage of 1,936 cesium and strontium capsules in the Waste Encapsulation and Storage Facility, which will be transferred to dry storage. Retrieval of contact- and remote-handled suspect transuranic waste in the low-level burial grounds will also be performed. About 27,000 cubic meters of transuranic waste is to be processed and shipped to the Waste Isolation Pilot Plant including: transuranic waste generated during retrieval operations, transuranic waste currently in storage, 618-10/11 waste site remediation waste, and facility decontamination and decommissioning waste. Additional sources of transuranic waste which could change the forecast waste volumes include pre-1970 burial ground remediation waste, canyon demolition waste, and transuranic tank waste. Processing of transuranic waste for shipment to the Waste Isolation Pilot Plant will occur in the Waste Receiving and Processing facility or the T Plant facility. About 70,000 cubic meters of mixed low-level waste will be treated to meet regulatory requirements and disposed in the mixed waste trenches or other facilities such as the Environmental Restoration Disposal Facility. This mixed low-level waste is either currently in storage or will be generated during retrieval operations, facility demolition, or from other on-site/off-site sources. Over 200 de-fueled naval reactor compartments will be disposed of in a dedicated trench. About 130,000 cubic meters of low-level waste will be disposed through site closure. This low-level waste is to be generated during facility demolition, or from other on-site and off-site sources, or is currently stored onsite. The 200 Area Effluent Treatment Facility, Liquid Effluent Retention Facility, and 300 Area Treated Effluent Disposal Facility provide treatment of cleanup generated liquid waste. Technical support is provided to all waste generators for all waste types. Other site-wide storage and disposal facilities will be transferred to this PBS in order to consolidate similar activities.

As of September 2009, 10,220 cubic meters of suspect transuranic waste have been retrieved; certified over 3,473 cubic meters of transuranic waste to be shipped to the Waste Isolation Pilot Plant; treated over 8,836 cubic meters of mixed low-level waste since January 2003; and completed the Tri-Party Agreement milestone for thermal treatment of 600 cubic meters of mixed low-level waste.

The end-state for this project will be that all retrievably stored, suspect transuranic waste is retrieved and transferred to a treatment, storage, and/or disposal facility; all spent nuclear fuel, cesium and strontium capsules are sent to an off-site disposal facility; all site waste disposal operations are complete; and, facilities are transitioned for decontamination and decommissioning.

In FY 2011, the following activities are planned:

- Provide site-wide services for day-to-day operations of general utilities, fire department, and analytical services.
- Provide base operations to support safe and compliant storage of Spent Nuclear Fuel.
- Operate and maintain the Canister Storage Building and 200 Area Interim Storage Area facilities and associated structures, operating systems and equipment, and monitoring systems.
- Provide base operations of the Integrated Disposal Facility.
- Provide base operations of disposal trenches for Hanford's mixed low-level waste.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Provide core management and base operations to store, treat and disposition low-level waste, mixed low-level waste, and transuranic waste at the Central Waste Complex and manage off-site commercial mixed low-level waste treatment/disposal contracts.

- Support the operation and necessary upgrades at the 200 Area Liquid Effluent Treatment Facility and Liquid Effluent Retention Facility.

- Provide the base operations necessary to store and treat mixed low-level waste and transuranic waste at the T Plant Complex. Also, provide upgrades necessary to maintain the facility and support for K Basin Project.

- Provide base operations for storage of cesium and strontium capsules at the Waste Encapsulation and Storage Facility.

- Provide the base operations of the Waste Receiving and Processing Facility necessary to support repackaging.

- A portion of the scope of work typically covered in this PBS is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	3,030	3,673	5,498	24,580	22.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	858	0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	48,572	48,572	48,572	51,450	94.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Treated 7,220 cubic meters (cumulative) of mixed low-level waste. (December 2008)
- Continued to operate 200 Area Liquid Effluent Facility (December 2009)
- Continue base operations and minimal upgrades to treat MLLW and transuranic waste (September 2010)
- Maintain base operations of the low-level waste and mixed low-level waste disposal facilities (Low-Level Waste Burial Ground , 218-W-5, trench 31 & 34) (September 2010)
- C-26-07F, Submit Tritium Technology Developments to Ecology and Environmental Protection Agency (March 2011)
- Provide Safe and Compliant Solid Waste Operations Facilities. (September 2011)
- Provide ready-to-serve facilities in support of site activities and American Recovery and Reinvestment Act workscope (September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RL-0030 / Soil and Water Remediation-Groundwater/Vadose Zone - 2035	**175,238**	**205,390**	**129,629**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS scope includes groundwater/vadose zone remediation activities that address groundwater contamination (e.g., carbon tetrachloride, chromium, technetium 99, strontium, and uranium plumes) and protection of the groundwater resources on the Hanford Site. Final substantive groundwater remedial actions are to be completed by 2024. Long-term monitoring, natural attenuation, and other regulatory review completion activities will continue through the 2042 time frame. The principal activities for this PBS include: 1) field characterization for movement of radionuclides and chemicals in the vadose zone and groundwater including treatability testing for deep vadose zone contamination; 2) assessing the soil and groundwater characterization results to determine the type and extent of contamination and evaluate various remedial alternatives to support completion of final remedial action decision-making for both the soil and groundwater; 3) vadose zone, groundwater and risk assessment modeling for selection of remedial alternatives and evaluating cumulative impacts to the Hanford groundwater and Columbia River; 4) operation of groundwater remediation systems and implementation of alternative methods to complete actions; 5) installation of wells to maintain Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and Resource Conservation and Recovery Act integrated, compliant, network to address emerging groundwater plumes, remediation requirements to conduct site-wide groundwater monitoring; 6) groundwater well drilling, maintenance, decommissioning; and 7) complete final restoration of groundwater on the Hanford Site.

Final Comprehensive Environmental Response, Compensation, and Liability Act feasibility studies and proposed plans for all soil and groundwater operable units at the Hanford Site will be completed by December 31, 2011. Groundwater completion activities will follow waste site closure activities through the 2024 time frame. By 2024, all existing unused wells will be physically decommissioned.

As of September 2009, achieved remedial action objective concentrations in all but one well for the H portion of the 100-HR3 groundwater operable unit cleanup site; reconfigured the pump-and-treat system to extract water to address the remaining contamination; decommissioned 90 high-risk wells to eliminate pathways to the groundwater; completed key field investigations for the carbon tetrachloride Dense Non-Aqueous Phase Liquid investigation in the 200 West Area; continued to operate four pump-and-treat systems for groundwater remediation; suspended the pump-and-treat system at 100-NR-2 and implemented an alternative passive barrier demonstration; successfully completed a year-long rebound study for UP-1 groundwater cleanup in 200 West Area; completed an alternative chromium remediation treatability test for the 100-KR-4 groundwater plume; and completed construction of another pump-and-treat system in 100-KR-4.

In FY 2011, the following activities are planned:

- Provide site-wide services for day-to-day operations of general utilities, fire department, and analytical services.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Perform remedial investigation and feasibility study to obtain final Records of Decision for the 100 Area River Corridor.

- Provide required groundwater monitoring program at Hanford for active remediation sites and Resource Conservation and Recovery Act Treat, Storage, and Disposal sites and maintain compliance with the current laws and regulations for groundwater monitoring.

- Integrate groundwater and vadose zone field support activities including operations and maintenance, safety personnel, worker training, and field equipment purchases for Hanford site cleanup activities.

- Provide management, training, and effective application of necessary project management tools, skills, and abilities that are required to operate the groundwater and vadose zone project.

- Support safety activities for the 100 Area River Corridor groundwater operable units (100-HR-3, 100-KR-4, 100-NR-2, 100-FR-3, 100-BC-5) including well maintenance, remediation operations, and project management.

- Conduct scientific applied research and technology development activities.

- A portion of the scope of work typically covered in this PBS is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Initiated design for final remedial actions for the ZP-1 groundwater operable unit in 200 West (October 2008) ▪ Initiated design for the final remedial action for 100-HR-3 at 100-D Area. (December 2008) ▪ Submitted 241-CX Series Storage Tanks Closure/Post Closure Plan to Ecology (December 2008)					

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Submitted a draft Comprehensive Environmental Response, Compensation, and Liability Act proposed plan (December 2009)
- Initiate physical testing of soil dessication and reactive gas soil cleanup technologies (September 2010)
- Continue to construct groundwater wells to support existing pump-and-treat operations (September 2010)
- Initiate installation of 100-HR-3 Pump & Treat Environmental Remediation System at 100-D Area (September 2010)
- Perform remedial investigation and feasibility study in support of 100-NR-2 Operable Unit (September 2010)
- M-024-62-T01, Conclude discussions of well commitments initiated under M-024-58 (August 2011)
- Support necessary groundwater operations and maintenance (September 2011)
- Support completion of the necessary characterization and supporting decision documentation (September 2011)

RL-0040 / Nuclear Facility Decontamination and Decommissioning Remainder of Hanford - 2035	**103,282**	**90,313**	**139,641**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS scope includes implementation of various Hanford Site cleanup initiatives: cleanup of radioactivity and chemical contamination in about 800 waste sites with potential impact to groundwater and approximately 900 facilities primarily on the Central Plateau; continuing litigation support; and infrastructure operations. Life-cycle work scope includes: decontamination, decommissioning, dismantlement, and disposition of surplus facilities (including canyon facilities); remediation of all 200 Area waste sites containing large inventories of mobile contaminants that may migrate into groundwater plumes (includes removal of contaminants or construction of surface barrier caps over waste sites); deactivation and disposition of contaminated equipment; final disposition of Cold War legacy wastes; site occupational medicine program; safe operation of facilities awaiting deactivation and demolition; and maintenance and repair of system infrastructure.

As of September 2009, activities completed include: remediation of 39 out of 857 waste sites and burial grounds; disposition of 250 excess facilities; and procurement of capital equipment replacements. Other activities include regulatory document development, surveillance and maintenance, infrastructure operations, and litigation support.

In FY 2011, the following activities are planned:

- Provide surveillance and maintenance activities to ensure safety for inactive waste sites and facilities on Hanford's Central Plateau.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Construction/Installation of barriers at Non-Radioactive Dangerous Waste Landfill and 600 Area Central Landfill.

- Provide for day-to-day operations of general utilities, fire department, and analytical services.

- Provide environmental Safety and Health oversight, quality management, safety, and job hazards analysis, technical support, and integration with site activities.

- Provide site infrastructure upgrades, replacements and repairs such as cranes, general plant facility HVAC replacements, fire truck and mobile response unit replacement, Hanford Local Area Network upgrades, roadway repair and sealing, and water line replacement/refurbishment.

- Provide steam for critical site heating systems.

- Provide training to ensure the safety and health of both Hanford and non-Hanford workers.

- A portion of the scope of work typically covered in this PBS is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	4	4	4	39	10.0%
Radioactive Facility Completions (Number of Facilities)	12	12	12	180	7.0%
Industrial Facility Completions (Number of Facilities)	232	232	232	649	34.0%
Remediation Complete (Number of Release Sites)	39	39	39	857	5.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Maintain safety and services for the Central Plateau (September 2010/September 2011)
- Maintain safe surveillance and maintenance for the Central Plateau (September 2010)
- Maintain safe surveillance and maintenance for Central Plateau (September 2011)
- Complete installation of a barrier at the Non-Radioactive Dangerous Waste Landfill (September 2011)
- Complete installation of a barrier at the 600 Area Central Landfill (September 2011)

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
RL-0041 / Nuclear Facility D&D-River Corridor Closure Project	**238,337**	**327,955**	**386,028**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The River Corridor Closure Project will complete the remediation of 761 contaminated waste sites (including liquid waste sites, solid waste sites, and burial grounds); complete the deactivation, decontamination, decommissioning, and demolition of 379 excess facilities/structures that are adjacent to the Columbia River; and complete the placement of eight reactors into an interim safe storage condition. The work scope includes the excavation of contaminated soil; the construction of interim safe storage (cocooning) of the reactors; deactivation, decontamination, decommissioning, and demolition of facilities/structures in the old reactor complexes and the facilities/structures in the 300 Area and 400 Area; operation of the Environmental Restoration Disposal Facility (or the Central Waste Complex in the case of Transuranic waste) for the disposal of the wastes generated by the project; construction of additional Environmental Restoration Disposal Facility disposal cells and surface barriers/caps over contaminated sites; activities supporting end state and final closure; surveillance and maintenance; utility operations; and closure and program management and support. Operation of the Environmental Restoration Disposal Facility is funded under this PBS because the River Corridor Closure Project is currently the primary user of the disposal facility.

As of September 2009, activities completed include: remediation of 451 of the 828 life-cycle waste sites and burial grounds; deactivating, decontaminating, decommissioning, and demolishing 196 of the 625 excess facilities; placing into an interim safe storage ("cocooning") 5 of 8 reactors; removing 2.3 metric tons of spent nuclear fuel from the 300 Area, which is in close proximity to the Columbia River and the local community; packaging and disposing of 2,958 containers of enriched uranium; packaging 3,100 containers of depleted and other uranium; and dispositioning 8.6 million tons of remediation waste into the Environmental Restoration Disposal Facility or Central Waste Complex (transuranic waste).

At project completion, DOE will seek approval to remove the project sites remediated according to interim Records of Decision from the National Priority List. There will be limited DOE activities remaining in the River Corridor after completion. At that time, the footprint of active Hanford Site cleanup will be significantly reduced from the present 586 square miles to about 75 square miles.

In FY 2011, the following activities are planned:

- Provide surveillance and maintenance of nuclear and support facilities and continue operations of key utilities (water, sewer electrical).
- Provide site-wide services for day-to-day operations of general utilities, fire department, and analytical services.
- Complete excavation of 3 of 5 100-H burial grounds.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Complete 22 interim remedial actions at the 100 B/C Area.
- Complete disposition of 8 facilities.
- Continue field remediation, deactivating, decontaminating, decommissioning, and demolishing of facilities, and interim safe storage in other areas along the Columbia River Corridor including maintaining critical functions in engineering, Safety, Health and Quality support, environmental compliance, and project controls.
- Continue disposing of thousands of tons of waste in the Environmental Restoration Disposal Facility.
- Initiate interim safe storage of the 105-KE Reactor, and D4 100K Area facilities.
- A portion of the scope of work typically covered in this PBS is being executed with American Recovery and Reinvestment Act funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Enriched Uranium packaged for disposition (Number of Containers)	2,958	2,958	2,958	2,958	100.0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	3,100	3,100	3,100	3,100	100.0%
Nuclear Facility Completions (Number of Facilities)	3	7	7	8	88.0%
Radioactive Facility Completions (Number of Facilities)	40	43	59	131	46.0%
Industrial Facility Completions (Number of Facilities)	144	156	199	389	46.0%
Remediation Complete (Number of Release Sites)	440	459	519	845	63.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Completed removal for 6 high-priority facilities (March 2009)
- Completed Waste Site 300-48 and Burial Ground 100-D-41 Load out (March 2009)
- Completed Burial Ground 118-H-1 Load Out (September 2009)
- Complete Interim Remedial Actions for 6 Specific Wastes Sites in the 300-FF-2 Operable Unit (September 2010)
- Continue field remediation in the 100 K-Area (September 2010)
- Complete disposition of 13 surplus facilities in the 300 and 100 Areas (September 2010)

- Complete Interim Remediation Actions At 100-B/C Area (November 2010)
- Continuation of facility disposition; field remediation; deactivation, decontamination, decommissioning and demolition; Interim Safe Storage; and Environmental Restoration Disposal Facility operations (September 2011)
- Complete excavation of a total of 3 of 5 100-H burial grounds (September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RL-0100 / Richland Community and Regulatory Support	**19,620**	**21,940**	**19,620**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The scope of this PBS includes regulatory and stakeholder support and assistance payments to offset lost property taxes (i.e., payments in lieu of taxes). The activities included in this PBS are: 1) regulatory costs as required by Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation, and Liability Act, Tri-Party Agreement, Clean Air Act, and other State and local laws and regulations. These include payment to the Washington State Department of Ecology as required by the Tri-Party Agreement, reimbursement to Washington State Department of Health for costs associated with fulfilling their Clean Air Act responsibilities as well as other miscellaneous air monitoring support activities, payment of waste discharge permit fees to Washington State Department of Ecology and other miscellaneous permits and fees; 2) grants to Washington State and Oregon State for their participation in Hanford related activities including environmental oversight and emergency preparedness activities; 3) payments in lieu of taxes made to the three host counties where the Hanford reservation is located; 4) funding to support the Hanford Advisory Board and related activities; and 5) Hanford Natural Resources Trustee activities. This PBS scope will end upon completion of the Hanford EM mission in 2048.

In FY 2011, the following activities are planned:

- Provide funding for Washington State Department of Ecology Resource Conservation and Recovery Act Mixed Waste Fee, Washington State Department of Health's air emissions monitoring invoice, and the Payment in Lieu of Taxes for Grant, Benton, and Franklin Counties.

- Provide funding for off-site agency emergency preparedness programs enabling them to respond to an emergency on the Hanford site, State of Oregon's input on Hanford activities and relative priorities for risk-based cleanup, and independent monitoring during events from the Washington State Department of Health.

- Support activities required by the Comprehensive Environmental Response, Compensation, and Liability Act regulations and DOE Natural Resource Damage Assessment policy.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Support activities required by the Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Tri-Party Agreement, Clean Air Act, and other State and local laws and regulations (September 2009)
- Support Washington and Oregon States emergency preparedness, environmental oversight and other activities related to Hanford cleanup (September 2009)
- Reimbursed the Department of Ecology and the Department of Health for regulatory oversight in accordance with the Tri-Party Agreement and state law (September 2009)
- Supported the Hanford Advisory Board for public involvement related to the cleanup mission (September 2009)
- Continue to provide support to the Natural Resource Trustee Council and the Hanford Advisory Board (September 2010)
- Continue to support various programs such as Resource Conservation & Recovery Act, Washington State Department of Health (September 2010)
- Support Washington and Oregon States emergency preparedness (September 2011)

	FY 2009	FY 2010	FY 2011
RL-0042 / Nuclear Facility D&D-Fast Flux Test Facility Project	**10,755**	**7,652**	**3,659**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This PBS scope includes deactivation and decommissioning the Fast Flux Test Facility, a 400-megawatt (thermal) liquid metal (sodium) cooled fast neutron flux nuclear test reactor, and 44 support buildings and structures. The deactivation activities consist of: reactor de-fueling; disposition of 376 reactor fuel assemblies by washing, drying, loading in storage casks and transferring to appropriate storage locations; draining approximately 260,000 gallons of sodium from operating plant systems, reactor vessel, and fuel storage vessels; sodium residual cleaning of all plant systems and vessels; disposition of the 260,000 gallons of bulk sodium by conversion to sodium hydroxide for use by the Waste Treatment Plant; and the shutdown of Fast Flux Test Facility auxiliary systems.

The current approach for the Fast Flux Test Facility Project is to complete sodium drain from the Fast Flux Test Facility to the Sodium Storage Facility, offload and store the reactor nuclear fuel and place the facilities in long-term surveillance and maintenance. The disposition of bulk and residual sodium and facility decommissioning and demolition will be deferred due to higher Hanford site priorities.

As of September 2009, all of the bulk sodium has been drained from the reactor plant and the fuel storage vessels. Sodium-potassium was flushed from the in-containment cooling loops and sodium-potassium was drained from the Fuel Storage Facility cooling loop. The bulk sodium drained and transferred to the Sodium Storage Facility constitutes ~260,000 gallons (100 percent) of the bulk sodium inventory. Sodium residuals remain throughout all the sodium systems. Of the original 376 fuel assemblies, 368 fuel assemblies have been washed, dried, and loaded into above ground Interim Storage Casks. Interim Storage Casks loaded with fuel assemblies were shipped to either the Plutonium Finishing Plant or the 200 Area Interim Storage Area. The remaining fuel assemblies were sodium-bonded and were transferred to the Idaho National Laboratory. The Fast Flux Test Facility and support facilities have been transitioned to long-term safe and compliant surveillance and maintenance.

The facility end-state for the Fast Flux Test Facility containment building, including the de-fueled reactor vessel, will be determined following the appropriate environmental analysis process. For planning purposes, it is assumed the reactor containment dome will be removed, the below-grade reactor containment building will be grouted and entombed, and the support facilities and structures will be demolished to three feet below grade and backfilled. The Fast Flux Test Facility end state alternatives are being evaluated in the Tank Closure/Waste Management Environmental Impact Statement.

In FY 2011 the following activities are planned:

- Maintain long-term safe and compliant surveillance and maintenance for Fast Flux Test Facility and support facilities.
- Provide site-wide services for day-to-day operations of general utilities, fire department, and analytical services.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	0	0	0	0	100.0%
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	7	7	7	7	100.0%
Nuclear Facility Completions (Number of Facilities)	0	0	0	4	0%
Radioactive Facility Completions (Number of Facilities)	0	0	0	9	0%
Industrial Facility Completions (Number of Facilities)	0	0	0	31	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Completed Fast Flux Test Facility operating systems deactivation to enable low cost surveillance and maintenance (August 2009)
- Transitioned Fast Flux Test Facility to long-term surveillance and maintenance (August 2009)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ Maintain minimum safe surveillance and maintenance for Fast Flux Test Facility (September 2010) ▪ Provide surveillance and maintenance to ensure minimum safety for the Fast Flux Test Facility and support facilities (September 2011)			
Total, Richland	**977,731**	**997,732**	**972,588**

Explanation of Funding Changes

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2012 Accelerated Completions and 2035 Accelerated Completions to newly created control points of Central Plateau Remediation and River Corridor and Other Cleanup Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The Explanation of Funding Changes Table below has been comparably adjusted to reflect the PBSs within the new control points in order to aid in the review process.

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Hanford Site	
Central Plateau Remediation	
RL-0011 / NM Stabilization and Disposition-PFP	
▪ Decrease is due to the completion of shipment of special nuclear materials from the Plutonium Finishing Plant and the reduced maintenance need for safe and compliant Plutonium Finishing Plant.	-21,731
RL-0012 / SNF Stabilization and Disposition	
▪ Decrease is due to progress on the continuation of sludge treatment design with procurement of multiple canister overpacks (Knock-Out Pot disposition), sludge treatment storage containers, and a Phase I storage alternative.	-32,696
RL-0013C / Solid Waste Stabilization and Disposition- 2035	
▪ Increase is due to planned upgrades to support the waste management operations facilities.	3,956

	FY 2011 vs. FY 2010 ($000)
RL-0030 / Soil and Water Remediation-Groundwater/Vadose Zone - 2035	
▪ Decrease is due to completion of the 200-BP-5 pump-and-treat system installation; reduced activities associated with the remedial investigation and feasibility studies to obtain final records of decision for groundwater operable units in the River Corridor and Central Plateau; deferment of construction of the phase two portion of the 200 West pump-and-treat system, and deferment of the 300-FF-5 Operable Unit characterization.	-75,761
River Corridor and Other Cleanup Operations	
RL-0040 / Nuclear Facility D&D-Remainder of Hanford - 2035	
▪ Increase is due to barrier construction/installation at the Non-Radioactive Dangerous Waste Landfill and the 600 Area Central Landfill. Also supports infrastructure reliability projects that support upgrades, replacements and repairs of the utility infrastructure for the Hanford Site.	49,328
RL-0041 / Nuclear Facility D&D-River Corridor Closure Project	
▪ Increase is due to additional activities for deactivation, decontamination, decommissioning, and demolition of facilities and structures in the 100 and 300 Areas and waste site and burial ground remediation in the 100 Areas. Includes acceleration of K East Reactor Interim Safe Storage and disposition activities.	58,073
RL-0100 / Richland Community and Regulatory Support	
▪ Decrease is due to reduced costs for Comprehensive Environmental Response, Compensation, and Liability Act and Resource Conservation and Recovery Act oversight.	-2,320
Non-Defense Environmental Cleanup	
Fast Flux Test Reactor Facility D&D	
RL-0042 / Nuclear Facility D&D-Fast Flux Test Facility Project	
▪ The decrease is due to the transition to long-term surveillance and maintenance.	-3,993
Total, Richland	**-25,144**

River Protection

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
River Protection	1,009,943	326,035	1,098,000	1,158,178
Total, River Protection	1,009,943	326,035	1,098,000	1,158,178

Site Overview

Hanford Site cleanup is managed by two Department of Energy offices, the DOE Richland Operations Office and the DOE Office of River Protection. Each office reports to the Office of Environmental Management.

In order to more effectively manage the River Protection Project and in response to Section 3139 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999, the Secretary of Energy established the Office of River Protection at the Hanford Site in the State of Washington. The Office is responsible for the storage, retrieval, treatment, immobilization, and disposal of tank waste and the operation, maintenance, engineering, and construction activities in the 200 Area Tank Farms. These Tank Farms include 177 underground storage tanks (149 single-shell tanks and 28 double-shell tanks) that contain approximately 190 million curies in approximately 53 million gallons of chemically hazardous radioactive waste from past processing operations. A multi-year construction project to build a Waste Treatment and Immobilization Plant to process and immobilize the tank waste is ongoing. The processed high-radioactivity fraction of the waste is being prepared for on-site storage pending final disposal and lower-hazard waste forms will be disposed in approved buried waste facilities on the Hanford site.

American Recovery and Reinvestment Act Activities

The Office of River Protection American Recovery and Reinvestment Act activities are funded at $326,035,000. Specifically, this funding will accelerate upgrades to tank farm infrastructure and waste feed delivery systems required to support the future transfer of tank waste, to the Waste Treatment and Immobilization Plant, which is scheduled to begin hot operations in FY 2019. The American Recovery and Reinvestment Act will also accelerate completion of existing environmental protection and site cleanup goals of immobilizing high-level waste at the Hanford Site, thereby mitigating environmental threats to the Columbia River.

Activities utilizing the American Recovery and Reinvestment Act funds include:

- Perform upgrades to the 222-S Analytical Laboratory and the 242-A Evaporator to ensure waste volume reduction operations and retrieval operations from aging single-shell tanks continue.

- Perform upgrades (e.g. ventilation, electrical, level rise modifications, etc.) within the tank farms to support future Tank Operations activities and waste feed delivery to the Waste Treatment and Immobilization Plant.
- Design and procurement of a new Core Sampling System to replace existing unreliable core/grab sampling systems.
- Complete pilot-scale testing of a transportable Wiped Film Evaporator system.
- Upgrade and automate the control system used for the cross-site transfer systems.
- Upgrade the SY Tank Farm transfer lines which are necessary to safely transfer waste during retrieval, blending, and delivery operations.
- Remove, package and dispose of obsolete/abandoned ventilation equipment in AW and AN Tank Farm.

The American Recovery and Reinvestment Act work scope will provide for integrated system planning for the DOE Office of River Protection mission and perform project planning, system upgrades/replacements, and operations to accomplish waste feed delivery to treatment facilities by 2019.

Site Description

The Hanford Site is the largest of the three original defense production sites founded in World War II as part of the Manhattan Project. The Hanford reservation is about half the size of the State of Rhode Island, at 586 square miles. Over its 40 years of operations, the site produced approximately 74 tons of plutonium—nearly two-thirds of all the plutonium recovered for government purposes in the United States. Between 1943 and 1963, nine plutonium production reactors were built along the Columbia River. Plutonium and reusable uranium were separated from irradiated fuel using various chemical precipitation and solvent extraction techniques. The plutonium and uranium were shipped to other DOE sites for eventual use in United States nuclear weapons.

During plutonium production, highly radioactive waste resulting from site operations was piped to underground tanks. In some cases small amounts of radioactive waste, representing small amounts of radioactivity, were discharged underground. For example, uncontaminated and slightly contaminated liquids and cooling water were pumped to ditches and ponds. Contaminated water discharged from the reactors was pumped to nearby soil as well as into the Columbia River. Solid waste was buried in shallow trenches or stored inside facilities. The result is more than 1,600 identified waste sites and more than 500 waste facilities at Hanford. Forty percent of the approximately one billion curies of radioactivity within the DOE nuclear weapons complex resides at Hanford. These materials must be dealt with in a safe and protective manner.

The DOE Office of River Protection is responsible for cleanup of the approximately 53 million gallons of waste in 177 underground storage tanks, as well as, contaminated equipment and soils in the 18 tank farms where these tanks are located on the Central Plateau of the Hanford site. Up to sixty-seven of the 177 tanks are assumed or suspected to have leaked waste in the environment.

Site Cleanup Strategy/Scope of Cleanup

Office of River Protection's cleanup strategy is a risk-based approach that focuses on contamination sources that are the greatest contributors to risk. Significant cleanup progress has already occurred. For example:

- Interim stabilization (in which transfer of pumpable liquids from Hanford's 149 single-shell tanks to safer double-shell tanks) has been completed, to reduce the risk of future tank leaks to the environment.
- Retrieval of remaining solids and sludges from seven single-shell tanks and four additional tanks to the limits of the first retrieval technology capability has been completed. The retrieval process on two single-shell tanks has been initiated, and design initiated on another.
- The Waste Treatment and Immobilization Plant is being designed and constructed to vitrify the bulk of the radioactive tank waste. It is the largest radioactive-chemical processing facility in the world: approximately 77 percent complete with design, approximately 48 percent complete with construction, and approximately 52 percent complete overall.
- Demonstration Bulk Vitrification System Full Scale Dryer Test and Integrated Dryer/Melter Test has been completed and design finalized. Bulk vitrification is a possible supplemental technology to increase the ability to treat Hanford's low-activity tank waste to supplement the Waste Treatment and Immobilization Plant capability.
- Retrieval of sludge/saltcake waste from the remainder of single-shell tanks continues.
- Construction of the Hanford integrated disposal facility, which will be used for the disposal of mixed low-activity wastes and low-level wastes, has been completed.
- Installation of the T Farm Interim Surface Barrier has been completed.
- The Interim Pretreatment System Project definition work related to technology testing and down selection, siting, feed selection and secondary waste management has been completed.
- The Draft Tank Closure and Waste Management Environmental Impact Statement has been completed and has been released for public comment.

Site Completion (End State)

The River Protection Project end state is to clean up the tank waste and tank farms in a compliant manner; immobilize and facilitate safe disposal of associated radioactive and chemical wastes; and protect human health, the environment, and Columbia River resources. The lifecycle planning estimate end date is 2042 to 2050. The following will have been accomplished at the completion of the Office of River Protection mission:

- High-level waste will be vitrified and ready for off-site disposal. Prior to shipment, all high-level waste forms will be stored in interim on-site storage facilities;

- Low-activity wastes will be stabilized and disposed of on-site;
- Appropriate remediation measures will be implemented for contaminated soils;
- Tanks and related equipment will be stabilized in place;
- Waste treatment systems will be decommissioned;
- Measures will be implemented to ensure the durability of protective conditions established throughout cleanup (e.g., durable surface barriers, long-term monitoring, markers, records, etc.).

Regulatory Framework

The principal regulatory drivers at the Hanford Site are the Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation, and Liability Act; and the Atomic Energy Act. In May 1989, DOE, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology signed the Hanford Federal Facility Agreement and Consent Order, commonly known as the Tri-Party Agreement. The Tri-Party Agreement defines legally enforceable milestones for Hanford cleanup.

The Tri-Party Agreement milestones listed below are subject to ongoing litigation in *State of Washington v. Chu*, Case No. CV-08-5085-FVS (Eastern District, Washington) based on the allegation that DOE has either missed, or is certain to miss:

- M-045-00B - Complete the retrieval of waste from sixteen C-Farm Single-Shell Tanks.
- M-045-05A - Complete waste retrieval from tank S-102.
- M-045-05 – Complete single-shell tank retrievals by September 30, 2018.
- M-062-00 - Complete Pretreatment processing and vitrification of Hanford high-level and low-activity tank wastes by December 31, 2028.
- M-062-00A - Complete Waste Treatment and Immobilization Plant pretreatment and high-level and low-activity vitrification of no less than 10 percent Hanford tank waste by volume and 25 percent by activity by February 28, 2018.
- M-062-07B – Complete assembly of the Low-Activity Waste melter; move High-Level Waste melter number 1 into the High-Level Waste building by December 31, 2007.
- M-062-08 - Submit Hanford Tank Waste Supplemental Treatment Technologies Report by June 30, 2006.
- M-062-09 - Start cold commissioning of the Waste Treatment and Immobilization Plant by February 28, 2009.
- M-062-10 - Complete hot commissioning of the Waste Treatment and Immobilization Plant by January 31, 2011.

On August 11, 2009, the Department of Energy and the Washington State Department of Ecology announced tentative agreement on revised timetables under the Tri-Party Agreement and a new Consent Decree to be filed in federal district court for cleanup of the Hanford Site. Major milestones include beginning treatment of waste at the WTP in 2019 (from 2011), emptying single-shell tanks of waste by 2040 (from 2018), and completion of treatment of all tank waste by 2047 (from 2028).

Critical Site Uncertainties and Assumptions

The River Protection Project is currently addressing a number of significant known uncertainties that are impacting the ability of the Hanford Site to disposition waste and complete the cleanup mission. Some of these uncertainties include:

- Delays in off-site disposal will require increased interim storage capacity for the vitrified canisters of high-level waste on site.
- Uncertainties regarding tank waste determination decisions because the State of Washington is not a "covered State" under Section 3116 of the National Defense Authorization Act of FY 2005. This could impact overall site tank closures, costs, and schedules because alternative approaches for tank closure may need to be developed.
- Successful identification, demonstration and regulator approval of a supplemental technology to immobilize a portion of the low-activity waste.

Interdependencies

The Office of River Protection has identified the following near-term interdependencies needed for mission execution:

- Technical consultation with the Nuclear Regulatory Commission on allowable waste residuals in the Hanford single-shell tanks based on Appendix H of the Tri Party Agreement.
- Availability of off-site disposal for high-level waste.

Contract Synopsis

The Office of River Protection currently has two major prime contracts to implement its cleanup strategy: the Tank Farm Operation contract and the Waste Treatment and Immobilization Plant contract. The Tank Farm Operation contract was awarded to Washington River Protection Solutions, LLC, and the contractor began execution on October 1, 2008, following a ninety day transition period. The contract is a five-year contract term with options for up to five additional years and addresses the following: (1) storage, operation, and interim stabilization of Hanford tank waste; (2) retrieval and disposition of waste from, and interim closure of single-shell tanks; (3) retrieval and disposition of waste from double-shell tanks, including completion of upgrades and waste retrieval and transfer systems; (4) construction, operation, and maintenance of facilities necessary for storage/disposal of immobilized waste whether on- or off-site, including balance of plant construction; (5) stabilization of facilities and preparation of tank closure plans for single-shell tanks; and (6) decommissioning and decontamination to support improved long-term operational efficiencies. This contract is a cost-plus-award-fee contract with performance-based incentives.

The Waste Treatment and Immobilization Plant contract with Bechtel National, Inc., includes the design, construction, and commissioning of the Waste Treatment and Immobilization Plant which includes: completing the Process and Facility Design; managing construction and procurement; conducting acceptance testing; commissioning of the facility; conducting all required environment, safety, quality, and health actions; assuming Full Design Authority; and having full accountability for meeting plant performance requirements, cost, and schedule. This contract type is a cost-plus-award-fee contract with, schedule, and operational incentives. In January 2009, DOE completed renegotiations of the contract with Bechtel National, Inc., the scope of which was based on the new Waste Treatment and Immobilization Plant Performance Baseline approved by the Deputy Secretary on December 22, 2006.

Cleanup Benefits

Near Term

- Retrieve liquid waste from single-shell tanks and transfer the waste to double-shell tanks for safe storage until the waste can be treated through the Waste Treatment and Immobilization Plant.
- Determine necessary supplemental treatment technologies for treating a portion of the low activity waste.
- Complete the Tank Closure and Waste Management Environmental Impact Statement.
- Continue development of technology for hard-heel tank waste removal.

Longer Term

Significant environmental risk reduction due to retrievals and treatment of Hanford's tank waste and closure of the tank farms to protect the Columbia River.

Direct maintenance and repair at the Office of River Protection is estimated to be $45,622,000.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Office of River Protection			
Tank Farm Activities			
ORP-0014 / Radioactive Liquid Tank Waste Stabilization and Disposition	319,943	408,000	418,000
Waste Treatment and Immobilization Plant			
ORP-0060 / Major Construction-Waste Treatment Plant	690,000	690,000	740,178
Total, Office of River Protection	1,009,943	1,098,000	1,158,178

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
River Protection					
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	9,667	0%
Industrial Facility Completions (Number of Facilities)	0	0	0	128	0%
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	54,000	0%
Liquid Waste Tanks closed (Number of Tanks)	0	0	0	177	0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	10,267	12,137	13,653	197,832	6.9%
Nuclear Facility Completions (Number of Facilities)	0	0	0	18	0%
Radioactive Facility Completions (Number of Facilities)	0	0	0	114	0%
Remediation Complete (Number of Release Sites)	5	5	5	278	1.8%
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	1,555	0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	4,410	0%

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
ORP-0014 / Radioactive Liquid Tank Waste Stabilization and Disposition	**319,943**	**408,000**	**418,000**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project includes activities required to stabilize approximately 53 million gallons of radioactive waste stored underground in 177 tanks, including retrieval, treatment, disposal and closure of the facilities.

The radioactive waste stored in the Hanford tanks was produced as part of the nation's defense program and has been accumulating since 1944. Due to the age of the tanks, up to sixty-seven tanks are suspected of leaking a total of about one million gallons of waste into the soil. Continued leakage could threaten the Columbia River, located between seven and ten miles away. In order to protect the river, the waste must be removed and processed to a form suitable for disposal, and the tanks stabilized. DOE's plan is to process tank waste and disposition it as vitrified high-level waste or low-level waste at an approved disposal facility. A Tank Closure and Waste Management Environmental Impact

Statement is being prepared to decide how to close the tanks, ancillary equipment below grade, and any residual waste that cannot be retrieved, as well as above ground facilities. Appropriate caps and barriers will be used to remediate the contaminated soil surrounding the tanks as required.

Specific activities in the scope of this project include:

- Manage the tank farms in a safe and compliant manner until the waste is retrieved for processing and the tank farms are closed.
- Design, construction, and operation of tank waste retrieval and transfer systems to transport the waste from the tanks for stabilization in either the Waste Treatment and Immobilization Plant or supplemental/alternative treatment facilities.
- Operation of treatment facilities to complete the tank waste program.
- Closure of 149 single-shell tanks, 28 double-shell tanks, tank farms, and facilities including completing necessary cleanup actions on tanks, ancillary equipment, contaminated soils, treatment facilities, facilities to store the vitrified high-level waste pending off-site disposal; and on-site low-activity waste disposal facilities.
- Construction of storage facilities where vitrified high-level waste canisters will be stored.
- Disposal of low-activity waste containers at the Hanford Site until all tank waste is stabilized.
- Operate the Waste Treatment and Immobilization Plant after construction and perform decontamination and decommissioning of the facility.
- Operate the 222-S Laboratory and the 242-A Evaporator.
- Conduct independent expert reviews and evaluations, and Environmental, Safety, Health, and Quality activities.
- Conduct scientific applied research and technology development activities to advance solutions for the treatment of radioactive waste including pre-treatment processes, tank structural integrity, and advanced retrieval technologies.

Currently, tank farm activities include: initiation of the retrieval system design and construction to support waste feed delivery to the Waste Treatment and Immobilization Plant; continued development of additional single-shell tank retrieval technology demonstrations; and operation of the 222-S Laboratory and the 242-A Evaporator. In addition, retrieval of the remaining solids and sludges from seven single-shell tanks has been completed. Construction of the integrated disposal facility was completed for future use in disposing of low-activity waste and mixed low-level waste. Initial design and engineering scale tests to resolve outstanding technical issues were successfully completed for the Demonstration Bulk Vitrification System, a supplemental technology to increase the ability to treat and dispose of Hanford's low-activity tank waste. The Demonstration Bulk Vitrification System Project Integrated Dryer/Full-Scale Melt Test final report was issued and laboratory analyses of samples from this test confirmed a successful melt and resolution of the molten ionic salt issue. Completed installation of the first interim barrier in T Farm to mitigate known contaminate plumes in the vadose zone under single-shell tanks.

DOE is developing a strategy to accomplish the tank cleanup mission within a 25 to 35 year timeframe. The Waste Treatment and Immobilization Plant has the capacity to immobilize 100 percent of the high level waste and 50 percent of the low activity waste within this timeframe. To address the remaining 50 percent of low activity waste, the approach is to conduct studies, evaluate alternative technologies, and conduct testing as needed for future options for low activity waste treatment. These activities will support a future DOE decision for pretreating and immobilizing the low activity waste.

In FY 2011, the following activities are planned:

- Complete two 242-A Evaporator Campaigns for space management.
- Complete retrieval of two C-Farm Single-Shell Tanks.
- Continue to perform single-shell tank integrity evaluations and implement expert panel recommendations.
- Operate the 222-S laboratory and 242-A evaporator.
- Complete removal of six hose-in-hose transfer lines.
- Initiate design and procurement activities to retrieve the next single-shell tanks.
- Initiate design of Interim Surface Barrier SX Farm.
- Initiate C-200 Closure Demonstration Project.
- Initiate C-301 Catch Tank Remediation.
- Continue Secondary Waste Treatment/Effluent Treatment Project design.
- Conduct supplemental treatment alternative studies.
- Conduct scientific applied research and technology development activities to advance solutions for the treatment of radioactive waste including pre-treatment processes, tank structural integrity, and advanced retrieval technologies.

- A portion of the scope of work typically covered in this project is being executed with American Recovery and Reinvestment Act funding as discussed above in the American Recovery and Reinvestment Act Activities section in the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Liquid Waste in Inventory eliminated (Thousands of Gallons)	0	0	0	54,000	0%
Liquid Waste Tanks closed (Number of Tanks)	0	0	0	177	0%
High-Level Waste packaged for final disposition (Number of Containers)	0	0	0	9,667	0%
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	1,555	0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	3,864	0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	10,267	12,137	13,653	197,832	7.0%
Nuclear Facility Completions (Number of Facilities)	0	0	0	18	0%
Radioactive Facility Completions (Number of Facilities)	0	0	0	114	0%
Industrial Facility Completions (Number of Facilities)	0	0	0	128	0%
Remediation Complete (Number of Release Sites)	5	5	5	278	2.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete three double-shell tank core samples and analysis to support tank integrity. (FY 2009)
- Perform three double-shell tank and two cross-site transfers. (FY 2009)
- Complete two evaporator campaigns for space management. (FY 2009/September 2011)
- Complete AP Tank Farm Level Rise for double-shell tank space management. (FY 2009)
- Continue to perform additional single-shell tank integrity evaluations (FY 2009/September 2010/September 2011)
- Replace evaporating heating, ventilation, and air-conditioning (exhaust side) to protect (September 2010)
- Complete one evaporator campaign for space management (September 2010)
- Complete retrieval of one C-Farm single-shell tank (September 2010)
- Conduct Double-Shell Tank Space Evaluation (September 2010)

(dollars in thousands)

- Operate the 222-S laboratory and 242-A evaporator (September 2010/September 2011)
- Perform Surveillance, monitoring and corrective maintenance of the Tank Farm facilities (September 2010)
- Remove Hose-in-Hose Transfer Lines (September 2010)
- Initiate design and procurement activities to retrieve the next C Farm single-shell tank (September 2010/September 2011)
- Complete installation of the TY Farm Interim Barrier (September 2010)
- Complete bulk retrieval of two C-Farm Single-Shell Tanks (September 2011)
- Complete removal of additional hose-in-hose transfer lines (September 2011)
- Design the SX Farm Interim Surface Barrier (September 2011)
- Initiate C-200 Closure Demonstration Project (September 2011)
- Initiate C-301 Catch Tank Remediation (September 2011)
- Initiate 242-CR Vault Characterization (September 2011)
- Finalize and submit pipeline feasibility study in support of Closure Demonstration (September 2011)

	FY 2009	FY 2010	FY 2011
ORP-0060 / Major Construction-Waste Treatment Plant	**690,000**	**690,000**	**740,178**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The scope of this project includes: design, construction, and commissioning of the line-item project 01-D-416, Waste Treatment and Immobilization Plant. In FY 2006, funds were appropriated at the line-item subproject level and the five subprojects are as follows: 01-D-16A - Low-Activity Waste Facility, 01-D-16B - Analytical Laboratory, 01-D-16C - Balance of Facilities, 01-D-16D - High-Level Waste Facility, and 01-D-16E - Pretreatment Facility. In FY 2010, the five subprojects for the Waste Treatment and Immobilization Plant Project were combined into two subprojects: 01-D-16A-D - Waste Treatment and Immobilization plant, and 01-D-16E - Pretreatment Facility. However, EM will continue to provide detailed information on the separate subprojects for Congressional review.

The Waste Treatment and Immobilization Plant is critical to the completion of the Hanford tank waste program by providing the primary treatment capability to immobilize (vitrify) the radioactive tank waste at the Hanford Site. The Waste Treatment and Immobilization Plant complex includes five major facilities: Pretreatment Facility, High-Level Waste Facility, Low-Activity Waste Facility, Analytical Laboratory, and the Balance of Facilities. The Pretreatment Facility will separate the radioactive tank waste into low-activity and high-level fractions. The high-level fraction will be transferred to the High-Level Waste Facility for immobilization (i.e., vitrified into glass), ready for disposal. At least 40 percent of the low-activity waste fraction will be transferred and immobilized (vitrified into glass) in the Low-

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Activity Waste Facility, with the balance immobilized using an alternative, supplemental treatment being developed on the Hanford Site. The Analytical Laboratory will provide real-time analytical support for plant operations. The Balance of Facilities includes office facilities, chemical storage, site utilities, and infrastructure.

This project also includes technical and managerial support to the Federal Project Director for the Waste Treatment and Immobilization Plant. Examples of this type of support include: project management and assessment of contractor performance. This allows the Department to be more proactive in identifying emerging cost and schedule issues. The Federal Project Director maintains full responsibility and accountability for the successful completion of the Waste Treatment Plant and Immobilization Plant project.

In FY 2011, the following activities are planned:

Accelerate completion of engineering and procurement to reduce risk and improve project confidence.

Low-Activity Waste Facility –
- Accept Thermal Catalytic Oxidizer a major off-gas component.
- Accept HEPA pre-heaters a major off-gas component.
- Complete 80 percent of bulk process piping installation and 65 percent of bulk conduit installation.

Analytical Laboratory Facility –
- Complete 90 percent of bulk piping installation.
- Complete 70 percent of bulk conduit installation.

Balance of Facilities –
- Accept delivery of the Anhydrous Ammonia System.
- Award purchase order of 4.16KV emergency diesel generator.

High-Level Waste Facility –
- Complete civil engineering design (Title II) and Architectural design.
- Receive HEPA filter housing, Off-Gas Blowers, and the Acidic Waste Vessel from suppliers.
- Set HEPA filter housing in Filter Cave.
- Place 9,000 cubic yards of concrete, 78 percent complete.
- Install 831 tons of structural steel, 27 percent complete.
- Install 9,100 linear feet of piping, 19 percent complete.
- Install 74,800 pounds of HVAC ducting, 27 percent complete.
- Install 16,900 linear feet of conduit, 20 percent complete.
- Install 1,900 linear feet of cable tray, 21 percent complete.

Pretreatment Facility –

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Receive Cesium Ion Exchange spiral plate heat exchangers (feed coolers).
- Receive Cesium Nitric Acid Recovery re-boiler and heat exchanger.
- Complete vessel upgrades for three spent resin collection and dewatering vessels to incorporate revised seismic assessment criteria.
- Place lower pipe module for the Low-Activity Waste feed receipt cell.
- Place 3,550 cubic yards of concrete, 83 percent complete.
- Install 555 tons of structural steel, 43 percent complete.
- Install 64,300 linear feet of piping, 21 percent complete.
- Install 11,450 pounds of HVAC ducting, 16 percent complete.
- Install 13,750 linear feet of conduit, 38 percent complete.
- Install 7,850 linear feet of cable tray, 26 percent complete.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	546	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Resumed construction of the high-level waste facility. (FY 2009)
- Issue-For-Construction Drawings for Pretreatment Concrete Walls, El. 56-77ft (FY 2009)
- Lab - Receive Waste Transfer Equipment (FY 2009)
- Lab Engineering - Title II Design Complete (FY 2009)
- Complete design for the Low-Activity Waste Facility (Title II). (FY 2009)
- BOF - Complete Installation of Cathodic Protection System (FY 2009)
- Low-Activity Waste Construction - Erect Switchgear Building (October 2009)
- Low-Activity Waste Construction - Receive Offgas Mercury Absorber (October 2009)
- High-Level Waste -Receive and Accept Melter Cave 1 Crane Maintenance (November 2009)
- DOE Approval of M-12 Closure (December 2009)
- Pretreatment Facility - Release for construction all steel work for the 4th floor (77 ft. level). (January 2010)
- Issue-For-Construction Drawings for the Pretreatment Rack Design (January 2010)
- High-Level Waste -Erect Structural Steel, EL 0-14ft (January 2010)
- Install Hot Cell cranes and shield doors in the Pretreatment Facility. (February 2010)
- Lab - Receive Autosampler (ASX) Equipment (February 2010)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ Low Activity Waste Facility - Melter 2 Lid and Balance of Components - Ready for Assembly (June 2010) ▪ Balance of Facilities - Complete Construction Water Treatment Building (July 2010) ▪ High-Level Waste Engineering - Complete HVAC Design (Title II) (September 2010) ▪ High-Level Waste Facility - Complete Civil Engineering Design (Title II) (February 2011) ▪ Pretreatment Facility - Set Hot Cell Frames for Areas 1, 24, and 25 (July 2011)			
Total, River Protection	**1,009,943**	**1,098,000**	**1,158,178**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Office of River Protection	
Tank Farm Activities	
ORP-0014 / Radioactive Liquid Tank Waste Stabilization and Disposition	
• Increase in funding will allow initiation of the C-301 Catch Tank remediation, the C-200 Closure Demonstration project and the 242-CR Vault Characterization.	10,000
Waste Treatment and Immobilization Plant	
ORP-0060 / Major Construction-Waste Treatment Plant	
• Increase in funding will accelerate completion of design and engineering that will directly support the completion of WTP engineering. Increased funding will support procurements for the accelerated incorporation of procured components into the final design. This accelerated completion will reduce risk and improve project confidence.	50,178
Total, River Protection	**60,178**

01-D-416 Waste Treatment and Immobilization Plant, Hanford, WA

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decisions are Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. Latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments are included with this Construction Project Data Sheet.

On August 2, 2009, a new Federal Project Director was appointed to be the acting Assistant Manager in charge of the Waste Treatment and Immobilization Plant, as the prior project manager had accepted a management position at the DOE Oak Ridge field site. The acting Federal Project Director has been certified to a Level II project manager in accordance with DOE's Project Management Career Development Program, and is applying for Level IV certification. A Level IV certification is the highest level and is required for projects where the Total Project Cost is greater than $400,000,000.

The following table provides a summary of the updated Earned Value Measurement Performance Measurement Baseline, Management Reserve/Fee identification, and Contingency use as established in the January 2009 contract revision. The March 2009 Baseline reflects updates to the approved December 2006 Baseline.

The funding increase of $50,178,000 over $690,000,000 will accelerate completion of design and engineering that will directly support the completion of WTP engineering. Increased funding will support procurements for the accelerated incorporation of procured components into the final design. This accelerated completion will reduce risk and improve project confidence.

	FY 2008 CPDS	**FY 2010 CPDS**	**FY 2011 CPDS**	
	(dollars in thousands)			
Description	**December 2006 Baseline**	**Jan. 2009 Baseline**	**March 2009 Baseline**	**Baseline Delta Dec. 06 to Mar. 09**
Performance Measurement Baseline	8,786,000	9,963,558	9,916,316	1,130,316
Management Reserve/Contract Contingency/Fee[a]	2,278,000	1,102,940	1,150,182	(1,127,818)
Subtotal, Contract Scope Costs	**$11,064,000**	**$11,066,498**	**$11,066,498**	**($2,498)**
Project Contingency	1,014,000	1,011,502	1,011,502	2,498
Other Project Costs	135,000	135,000	135,000	0
Transition Cost (from Privatization Contract)	50,000	50,000	50,000	0
Subtotal, Other Scope Costs	**$1,199,000**	**$1,196,502**	**$1,196,502**	**$2,498**
Total Project Cost	**$12,263,000**	**$12,263,000**	**$12,263,000**	**$0**

[a] This line, after the 'December 2006 Baseline' column, does not include $400 million of Contract Contingency, which was moved to the Project Contingency controlled by DOE. In a separate action, $93 million of Project Contingency was transferred to Management Reserve/ Fee in accordance with the January 2009 contract revision.

There is no change in the Total Project Cost for the Fiscal Year 2011 Construction Project Data Sheet and the issues associated with the External Flowsheet Review Team have been resolved.

The project still maintains a Management Reserve of about $530,000,000, and a Project Contingency of about $1,011,502,000 for the remaining scope.

Status of Major Technical and Performance Issues

The Department along with the contractor and other independent experts worked towards resolving these issues in FY 2009:

1) **Inadequate vessel mixing** - This issue relates to whether adequate mixing of the fluids and solids in the vessels can be achieved using the proposed technology of pulse jet mixers. Inadequate Newtonian fluid mixing could limit the capability of the Waste Treatment and Immobilization Plant and extend the facility's treatment mission. A testing program has been designed to fully demonstrate the technology. Parametric testing of mock pulse jet mixers using glass beads of varying sizes and densities was completed in early August 2008. Data was evaluated to develop pulse jet mixer mixing correlations. A second phase of testing is currently underway to further test and evaluate the adequacy of pulse jet mixer mixed vessels. A second round of testing has been completed on the Feed Evaporator Process vessel and Ultra-filtration Process vessel designs and work is proceeding to evaluate alternative designs for the High Level Waste Process receipt vessel. The current plan is to complete testing and close M-3 by June 2010. Design improvements are being identified for those vessels at risk of not meeting their mixing requirements.

2) **Ultrafiltration and Undemonstrated Leaching Process** – This issue relates to the concern that the ultrafiltration system and leaching process had not been demonstrated beyond small-scale laboratory tests. The contractor has performed modeling to develop optimum ultrafiltration system operating approaches, tested tank waste samples using the optimized flowsheet, and developed simulants. These activities are complete or are in final stages of report writing. The final action of the issue response plan required testing the ultrafiltration flowsheet at engineering scale. This testing was completed with the Pretreatment Engineering Platform.

The Pretreatment Engineering Platform is a 1:4.5 scale non-radioactive integrated equipment platform which demonstrates the ultrafiltration system, leaching process design, system scale-up, and improved projections of system capacity. Simulant testing was completed in April 2009. These tests provided critical information needed to confirm ultrafiltration system design by demonstrating caustic leaching, oxidative leaching, solids washing, and process control strategies. Initial test results appeared to confirm the flowsheet design. Final evaluation of this data, in conjunction with other laboratory testing and modeling, confirmed the ultrafiltration system design and provided improved estimates of system capacity and projection of mission duration. This issue was closed in September 2009.

Defense Nuclear Facilities Safety Board Oversight

The Defense Nuclear Facilities Safety Board (Board) provides nuclear safety oversight of the Waste Treatment and Immobilization Plant Project. The Board had identified several issues with the Waste Treatment and Immobilization Project in their quarterly reports to Congress on defense DOE projects in design and construction. These include: 1) concerns with structural analysis of the High-Level Waste and Pretreatment facilities, including modeling, definition of a seismic load transfer capability in the structure, and the finite element analysis; 2) lack of fire protection coatings on secondary structural steel members; 3) alternative means of protecting the final exhaust High-Efficiency Particulate Air filters of the confinement ventilation systems equivalent to that of the features prescribed in DOE Standard 1066, *Fire Protection Design Criteria*, and 4) hydrogen gas control. The Department has resolved the first three issues and is working diligently to resolve the fourth issue:

1) Structural Analysis of High-Level Waste and Pretreatment facilities – In 2008, the Department completed the last of the technical analyses to support resolution of this issue. This was the documentation of the load path analysis of the High-Level Waste and Pretreatment facilities under a design seismic event in High-Level Waste and Pretreatment Structural Summary Reports. The project has incorporated technical and editorial comments by the Board and has submitted updated reports to the Defense Nuclear Facilities Safety Board. DOE will evaluate the selected use of the specific Waste Treatment Plant project seismic criteria for vessels and equipment still under design and construction.

2) Fire Protection Coatings of Structural Steel - In January 2009, the Board sent DOE a letter that noted that the High-Level Waste and Pretreatment facilities essentially meet International Building Code criteria for fire resistant construction. The letter noted that the Board agreed with the conclusion that the fire protection strategy for structural steel was adequate based on consequence of nuclear safety, but that to fully resolve the issue it needed confirmation that chemical consequences from a fire would be acceptable. In its June 22, 2009, quarterly report to Congress, the Board noted that subsequent review revealed that the planned fireproof coating is adequate to prevent a structural collapse that would release hazardous chemicals in the event of a design basis fire. This issue is now considered closed.

3) Application of DOE criteria for fire protection of confinement ventilation systems – The project has included the criteria of a DOE technical standard as requirements for fire protection of filters in confinement ventilation systems that preclude the release of radioactive materials. The DOE decided to tailor sections of the DOE technical standard based upon its evaluation of the safety analysis, which concluded that the design provided a level of safety comparable to the standard. The design was modified to incorporate some significant safety features and the Assistant Secretary for Environmental Management approved the ventilation system design as a part of the approval needed for compliance with the Department's Implementation Plan for a Defense Nuclear Facilities Safety Board recommendation for active confinement ventilation systems. This issue is now closed.

4) Hydrogen gas generation- DOE had previously developed a conservative design criterion and an adequate set of engineered and administrative controls to address potential explosions (deflagrations and detonations) in piping and ancillary vessels as a result of hydrogen accumulation. The Department initiated actions to re-evaluate the design criteria and associated controls due to its concerns regarding the operational complexity introduced by the controls. The Defense Nuclear Facilities Safety Board identified concerns with an approach that would allow explosions that could

permanently deform the primary confinement barrier, as well as the consistency between DOE's approach and applicable code requirements for vessel and piping designs.

The Defense Nuclear Facilities Safety Board has also identified some concerns with other recent Waste Treatment and Immobilization Plant initiatives to reduce complexity associated with future operations of the plant. The DOE is evaluating refinement to more realistic – but still conservative source terms (i.e., by review of the material at risk), through advances in characterizing tank farm wastes, as a means of minimizing operational complexity and enhancing operational safety of the plant. Initial results from a Technical Authority Review indicate that a sound basis exists to support reclassifying some select systems. Recommendations have been developed and DOE has approved the contractor's safety documentation with four conditions that need to be addressed in FY 2010 in order to achieve full implementation.

Background

This Construction Project Data Sheet is structured with summary information at the project level with details provided at the subproject level. Through FY 2005, the Waste Treatment and Immobilization Plant Project had been funded as one line item (01-D-416). In FY 2006, the Waste Treatment and Immobilization Plant Project was split into five subprojects. In the FY 2010 Appropriation, the five subprojects for the Waste Treatment and Immobilization Plant Project were combined into two subprojects:

- 01-D-16A-D, Waste Treatment and Immobilization plant
- 01-D-16E, Pretreatment Facility

However, EM is providing detailed information on the five separate subprojects to maintain visibility for Congressional review:

- 01-D-16A, Low-Activity Waste Facility
- 01-D-16B, Analytical Laboratory
- 01-D-16C, Balance of Facilities
- 01-D-16D, High-Level Waste Facility
- 01-D-16E, Pretreatment Facility

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2001 Budget Request	4Q FY1995	4Q FY1996	4Q FY2005	4Q FY1998	1Q FY2002	1Q FY2007	N/A	N/A
FY 2002 Budget Request	4Q FY1995	4Q FY1996	4Q FY2005	4Q FY1998	3Q FY2002	1Q FY2007	N/A	N/A
FY 2003 Budget Request	4Q FY1995	4Q FY1996	4Q FY2005	4Q FY1998	3Q FY2002	1Q FY2007	N/A	N/A
FY 2004 Budget Request	4Q FY1995	4Q FY1996	4Q FY2005	4Q FY1998	3Q FY2002	1Q FY2007	N/A	N/A
FY 2003 Congressional Notification	4Q FY1995	4Q FY1996	4Q FY2005	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2005 Budget Request	4Q FY1995	4Q FY1996	4Q FY2005	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2004 Reprogramming	4Q FY1995	4Q FY1996	4Q FY2005	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2006 Budget Request	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2007 Budget Request	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008 Budget Request	4Q FY1995	4Q FY1996	4Q FY2010	3Q FY2003	3Q FY2003	2Q FY2017	N/A	N/A
FY 2009 Budget Request	4Q FY1995	4Q FY1996	4Q FY2013	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2010 Budget Request	4Q FY1995	4Q FY1996	1Q FY2016	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011 Budget Request	4Q FY1995	4Q FY1996	1Q FY2016	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:
1) The FY 2009 Budget Request 'PED Complete' date was based on the June 2007 Execution Revision schedule.
2) The FY 2004 Budget Request 'CD-3' date of 4Q FY 2002 represented the start of physical construction. The FY 2003 Congressional Notification 'CD-3' represents the date approval was granted to begin full construction (CD-3c).
3) The FY 2008 Budget Request 'CD-4' date of 2Q FY 2017 represented the completion of physical construction of the WTP facilities. In the FY 2009 Budget Request, the 'CD-4' completion date represents the completion of construction, start-up, commissioning and transfer of the Waste Treatment Plant to the operations contractor.
4) In the FY 2010 Budget Request, the 'PED Complete' date reflects contract dates from the revised January 2009 contract.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2001	0	5,466,000	5,466,000	7,022,000	0	7,022,000	12,488,000
FY 2002	0	4,350,000	4,350,000	0	0	0	4,350,000
FY 2003	0	4,350,000	4,350,000	0	0	0	4,350,000
FY 2004	0	4,350,000	4,350,000	0	0	0	4,350,000
FY 2003 Cong. Notification	0	5,781,000	5,781,000	0	0	0	5,781,000
FY 2005	0	5,781,000	5,781,000	0	0	0	5,781,000
FY 2006	0	5,781,000	5,781,000	0	0	0	5,781,000
FY 2007	0	5,781,000	5,781,000	0	0	0	5,781,000
FY 2008	0	12,263,000	12,263,000	0	0	0	12,263,000
FY 2009	0	12,263,000	12,263,000	0	0	0	12,263,000
FY 2010	0	12,263,000	12,263,000	0	0	0	12,263,000
FY 2011	0	12,263,000	12,263,000	0	0	0	12,263,000

The FY 2001 Budget Request presented the contract value using a privatization approach for this project. The contract included design, construction, and commissioning (at a Total Estimated Cost of $5,466,000,000), and ten years of initial operations, which would treat approximately 10 percent of waste by volume, and 25 percent of the waste, by radioactivity, for a Total Project Cost of $12,488,000,000. The plant was designed to have a 40 year operational life, during which time it would process a total of 40 percent of the waste by volume. A second plant (not part of the current project contract) would be necessary to treat and immobilize the balance of the low-activity waste. In May 2000, the Secretary of Energy terminated the privatization contract, because of the dramatic cost increase submitted by the contractor to complete the project.

In December 2000, the Department awarded a Cost-Plus Incentive-Fee contract estimated at $4,350,000,000 to design, construct and commission the Waste Treatment and Immobilization Plant. In April 2003, a contract modification was negotiated with the principal change of increasing the through-put capacity of the Pretreatment and High-Level Waste Facilities, with the goal of pretreating all of the waste during the 40 year life of the facility, immobilizing all high-level fraction and at least 40 percent of the low-activity fraction. The Department approved a Performance Baseline with a Total Project Cost of $5,781,000,000. In December 2006, due to over-optimistic cost estimates, and seismic and technical issues, the Department approved a new Performance Baseline with a revised Total Project Cost of $12,263,000,000.

4. Project Description, Justification, and Scope

The Waste Treatment and Immobilization Plant is the cornerstone of the River Protection Project's mission to clean up hazardous and radioactive waste contained in underground storage tanks at the Hanford Site in southeastern Washington State. Approximately 53,000,000 gallons of waste containing approximately 240,000 metric tons of processed chemicals and 190,000,000 curies of radio nuclides are currently stored in 170 tanks (seven tanks have been emptied). These caustic wastes are in the form of liquids, slurries, saltcakes, and sludge, and are the result of more than four decades, starting in 1944, of reactor operations and plutonium production for national defense. The infrastructure that supports storage of this waste is aging. The construction of the Waste Treatment and Immobilization Plant and its subsequent operation, once completed will treat and stabilize the bulk of these wastes.

The Waste Treatment and Immobilization Plant, the world's largest most complex nuclear waste treatment plant, covers 65 acres and includes three major nuclear facilities - Pretreatment Facility, High-Level Waste Facility, and Low-Activity Waste Facility - along with a large Analytical Laboratory, and supporting buildings and utilities collectively known as the Balance of Facilities.

The Department's Office of River Protection is responsible for managing the critically important effort to design, build, and commissioning the waste treatment plant. The Waste Treatment and Immobilization Plant is an unprecedented engineering and construction challenge equivalent to simultaneously building two nuclear power plants. Through a process known as vitrification, most of Hanford's tank waste volume will be transformed into a sturdy, durable form by blending the waste with molten glass and pouring it into stainless steel canisters. In that form, the waste will remain stable and impervious to the environment while its radioactivity dissipates over hundreds to thousands of years.

The Office of River Protection is implementing cleanup under two contract vehicles:

- The Tank Operations Contractor provides for safe storage and retrieval of tank wastes, storage and disposal of treated waste, decontamination and decommissioning of tanks, and initiation of post closure monitoring of the tank farms. The scope of work for this contract also includes providing the infrastructure to support hot commissioning.
- The Waste Treatment and Immobilization Plant Project's Contractor is to design, construct, commission, and support transition of the plant into full operation.

The Waste Treatment and Immobilization Plant contractor will complete process and facility design; perform construction and procurement; conduct acceptance testing; select and integrate a subcontractor into the project team to provide the necessary operating and commissioning capability; and conduct all required environmental, safety, quality, and health actions. From contract award, the contractor is the design authority responsible for the design of the plant.

When operating, the Waste Treatment and Immobilization Plant will pretreat tank waste through separation into a high-level fraction and a low-activity fraction. Both fractions will be immobilized through vitrification into glass. The immobilized high-level fraction is planned to be disposed in a national geologic repository for spent fuel and high-level waste or will be temporarily stored on the Hanford site in a canister storage building. The immobilized low-activity fraction will be placed in a disposal facility on the Hanford site. The plant is composed of five facilities which are integrated to accomplish the mission for the Waste Treatment and Immobilization Plant Project. The Pretreatment Facility accomplishes the separation of the wastes. The High-Level Waste Facility will immobilize, through vitrification, the entire high-level fraction. The Low-Activity Waste Facility will immobilize, through vitrification, a substantial portion of the low-activity fraction. The Analytical Laboratory Facility will provide the necessary sample analysis needed throughout the processing facilities. The Balance of Facilities includes the plant infrastructure and support facilities (steam plant, electrical switch yards, chiller plant, etc.).

The River Protection Project regulatory pathway for cleanup has been provided in the past primarily by the Hanford Federal Facility Agreement and Consent Order, commonly known as the Tri-Party Agreement. On August 11, 2009, the Department of Energy and the Washington State Department of Ecology announced tentative agreement on revised timetables under the Tri-Party Agreement and a new Consent Decree to be filed in federal district court for cleanup of the Hanford Site. Major milestones include beginning treatment of waste at the Waste Treatment and Immobilization Plant in 2019 (from 2011), emptying single-shell tanks of waste by 2040 (from 2018), and completion of treatment of all tank waste by 2047 (from 2028).

FY 2009 Accomplishments:

For the Low-Activity Waste Facility, Title II Design and Engineering were completed, and both glass former mixers, melter off-gas fabricated piping sections and power supply equipment were received. Construction forces completed installation of roof/wall stainless steel liner plate in the melter pour caves, erection of structural steel on the receiving dock, and continued installation of piping, hangers and other commodities.

For the Analytical Laboratory, Title II Design and Engineering were completed, and the waste transfer system and mechanical handling hot cell equipment were fabricated and received onsite. Construction continued with installation of drywall partitions, piping, hangers, and other commodities. Placement of the north-end concrete wall of the hot cell and 55 percent of the heating, ventilation and air conditioning, ducting were completed. Balance of Facilities progress included issuing drawings for the Anhydrous Ammonia Facility and award of a purchase order for the anhydrous ammonia vaporizers skids, final construction completion of the Steam Plant, and completing installation of the Cathodic protection system.

For the High-Level Waste Facility, major design activities include releasing the remaining concrete embed drawings to fabrication for second to third floor walls, and issuance of the High Level Waste documentation that demonstrates compliance with repository program requirements. Procurement activities included delivery of key materials and equipment, including the High Level Waste Offgas system High-Efficiency Mist Eliminators, second to third floor concrete embedments and pipe connection assemblies, Melter Cave #1 and #2 shield doors, and awarding the contract for the vertical shield door recovery assembly and the melter offgas Thermal Catalytic Oxidizer. Construction activities included completion of 30 walls and 16 slabs on the first to second floor, continued civil build out, and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities. Also completed were the canister transfer cart maintenance crane steel/rails, Melter #2 pour tunnel canister transfer cart maintenance room crane and shield door, and filter cave crane maintenance shield door frame assembly.

For the Pretreatment Facility, design activities include release of design for remaining 13 of 50 reinforced concrete walls between the third and fourth floors, release of roof framing drawings, which completes the release of the main Pretreatment building structure, and issuance of all pipe isometric drawings for the low-activity waste feed receipt area. Construction activities include installation of the 20-ton waste handling area spent filter radiological shield door, and completing erection of the building main frame steel work at the west end of the building from the third to fourth floors.

It was anticipated that the remaining unresolved technical issues of the 31 issues identified by the External Flowsheet Review Team, would be resolved and approved by the Office of River Protection Project Manager by the end of the fiscal year. Tests conducted with the Pretreatment Engineering Platform were used to verify the operational capabilities of critical systems of the Pretreatment Facility; however, an additional test platform to test effectiveness of mixing using pulse jet mixers has been procured, and is still being used to verify the mixing design.

FY 2010 Planned Activities:

For the Low-Activity Waste Facility, the remaining piping fabrication, system logic diagrams, and updated melter design drawings will be completed, as well as issuance of the Low-Activity Waste Facility Waste Qualification Report. Construction activities will continue with the installation of miscellaneous steel and piping, heating, ventilation, and air conditioning duct, cable trays, conduit, and cable and wire. Erection of the switchgear building and truck bay will also be completed. Major equipment installations will include the carbon bed absorber, and fabrication and shipment of the lids for both melters.

For the Analytical Laboratory, engineering will complete the mechanical system confirmed calculations and Process and Instrumentation Diagrams. The Autosampler System equipment and two axial filter housings will be delivered to the site. Construction forces will complete installation of elevated concrete for the waste collection tank pit, and miscellaneous piping and heating, ventilation and air conditioning ducting (90 percent complete) will continue to be installed. For the Balance of Facilities, mechanical handling design will be completed for multiple facilities. Construction of the Water Treatment building, Balance of Facilities Switchgear Building, Fuel Oil Facility, and Cooling Tower Facility will be completed. Installation of commodity racks, piping, and electrical systems for various facilities will also continue to progress.

For the High-Level Waste Facility, design activities included completion of Heating, Ventilation and Air Conditioning Title II design, Autosampler system design, and issuance of civil engineering drawings for slabs at the fourth floor elevation. Procurement Activities include fabrication and delivery of the first High-Level Waste Melter Assembly, Melter cave #1 crane maintenance shield door, and two Melter feed vessel agitators. Construction activities include completion of 25 walls and 11 slabs on the first to third floors for a total of 4,720 cubic yards of concrete placed, erection of structural steel between the first and second floors, setting of six Melter shield doors in Melter caves #1 and #2, continuation of civil build out, and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities.

For the Pretreatment Facility, design activities include release of design for the final 13 of 47 12-inch thick reinforced concrete floor slabs for the fourth floor (this release provides an additional 1,100 cubic yards of concrete for construction to place), release of design for the final 9 of 36 reinforced concrete walls between the fourth to fifth floor (this release provides an additional 650 cubic yards of concrete for construction to place). Procurement activities include delivery of the three demister units for the Pretreatment filter cave to the material handling facility. Construction activities include lift of the 112-ton ultra filtration feed preparation vessel, and completion of concrete wall and slab placements on the third and fourth floors.

FY 2011 Proposed Activities:

For the Low-Activity Waste Facility, the remaining mechanical system confirmed calculations and Process and Instrumentation Diagram drawings will be completed. The melter off gas catalytic oxidizer and high-efficiency particulate air pre-heaters will be received. Construction continues with piping, hanger, electrical conduit, and other commodity installation, and the melter off gas catalytic oxidizer will be set in-place. For the Analytical Laboratory, 90 percent of bulk piping installation and 70 percent of bulk conduit will be completed, as well as completion of the heating, ventilation and air-conditioning equipment on the second floor. For the Balance of Facilities, major activities will be the award of the purchase order for the 4.16kV emergency diesel generator, and receipt of the anhydrous ammonia system.

For the High-Level Waste Facility, design activities include completion of Title II Civil Engineering and Architectural Design. Major procurement activities include receipt of the High Efficiency Particulate Air filter housings and dampers for the primary ventilation system, Plant Wash Vessel #8, and High-Level Waste Melter Offgas Treatment Process System fans. Construction activities include completion of 50 concrete walls and slabs on the second to third floors, continuation of civil build out and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities, installation of High Efficiency Particulate Air filter housings in the Filter Cave and stainless steel liners in Pour Tunnels #1 and #2.

For the Pretreatment Facility, procurement activities include delivery of the Cesium Ion Exchange spiral plate heat exchangers (feed coolers) and Cesium Nitric Acid Recovery re boiler and heat exchanger. Construction activities include completion of vessel upgrades for three spent resin collection and dewatering vessels to incorporate the revised seismic assessment criteria, lift of the lower pipe module for the Low-Activity Waste feed receipt cell, and setting support frame structures for process jumpers and process equipment in the hot cell.

Estimated Engineering and Design Status through FY 2011. In FY 2008 the Waste Treatment and Immobilization Plant contractor identified the need for additional engineering work to support the completion of facility design and support construction activities. Completion of the Title II design (work required to allow the placement of walls and installation of piping, cable and structural steel, and procurement of major equipment) had been more difficult than originally anticipated. Earlier Engineering estimates had not included sufficient hours to support vendor design changes and resolve unforeseen technical issues during the construction of the facilities. In a December 2008 internal replan, two million additional engineering hours were added across the five Waste Treatment and Immobilization Plant facilities, resulting in an overall decrease in the engineering/design percent complete. However, the following percent completes now include engineering work associated with Research and Technology, and Environmental and Nuclear Safety, which increases the percent complete values.

Funding increase of $50,178,000 over $690,000,000 will accelerate completion of engineering and procurement to reduce risk and improve project confidence.

The following table provides the estimated design status for each of the five subprojects at fiscal yearend for FY 2009 through FY 2011.

Engineering/Design Complete	**FY 2009**	**FY 2010**	**FY 2011**
Low-Activity Waste	92%	96%	97%
Analytical Laboratory	79%	85%	86%
Balance of Facilities	77%	85%	90%
High-Level Waste	81%	87%	91%
Pretreatment	76%	83%	91%
Total WTP [1]	77%	83%	88%

[1] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

Appropriations	Obligations	Costs

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2001[a]	401,171	401,171	226,311
FY 2002	665,000	665,000	488,469
FY 2003[bc]	671,898	671,898	621,574
FY 2004[d]	697,530	682,402	725,246
FY 2005[e]	684,480	695,552	811,862
FY 2006	520,759	524,815	516,002
FY 2007[fgh]	690,000	621,000	550,991
FY 2008[i]	683,721	752,721	727,764
FY 2009	690,000	690,000	738,987
FY 2010	690,000	690,000	804,004
FY 2011[j]	740,178	740,178	739,787
FY 2012	690,000	690,000	671,588
FY 2013	690,000	690,000	720,717
FY 2014	690,000	690,000	714,619
FY 2015	690,000	690,000	719,614
FY 2016	690,000	690,000	649,601
FY 2017	690,000	690,000	650,780
FY 2018	640,000	640,000	717,457
FY 2019	348,263	348,263	357,601
FY 2020	-	-	110,026
Total, Construction	12,263,000	12,263,000	12,263,000

(a) FY 2001 Appropriations reflect a FY 2001 Rescission of $829,000 and FY 2001 Supplemental Appropriation of $25,000,000. The original appropriation was $377,000,000.

(b) FY 2003 Appropriations reflect approved FY 2003 reprogramming of $83,981,567 to increase the project from $606,018,433 to $690,000,000 to meet project requirements.

(c) FY 2003 Appropriations and Obligations reflect a reduction of $18,102,000 as part of the FY 2004 Energy and Water Development Appropriation Act prior year reduction.

(d) FY 2004 Appropriations reflect a reduction of $3,964,000 due to FY 2004 Government-wide Rescission of 0.59 percent and increase of $11,494,000 due to a reprogramming.

(e) FY 2005 Appropriations reflect a reduction of $5,520,000 due to FY 2005 Government-wide Rescission of 0.8 percent.

(f) New WTP Project Performance Baseline as approved on December 22, 2006.

(g) The FY 2007 National Defense Authorization Act states that only 90 percent of funds may be obligated until the Secretary of Energy certifies the WTP Earned Value Management System. In March of 2008 the WTP Earned Value Management System received certification.

(h)The Prior Year Appropriations, Obligations, and Costs have been updated to reflect a more current estimate of the anticipated utilization of the non-facility specific carryover funding remaining in the WTP line-item, 01-D-416.

(i) FY 2008 Enacted Appropriations reflect a reduction of $6,278,000 due to the FY 2008 rescission of 0.91 percent.

(j) Funding increase of $50,178,000 over $690,000,000 will accelerate completion of engineering and procurement to reduce risk and improve project confidence.

The following table breaks out appropriations by Subproject:

($ thousands)

WTP Project	Prior	FY09	FY10	FY11	Outyears	Total
Low-Activity	1,157,199	160,000	100,000	57,500	609,301	2,084,000
Analytical Lab	274,090	65,000	55,000	2,500	393,410	790,000
Bal of Facilities	522,845	75,000	50,000	5,000	557,155	1,210,000

High-Level	1,276,889	125,000	160,000	260,178	1,417,933	3,240,000
Pretreatment	1,783,536	265,000	325,000	415,000	2,150,464	4,939,000
Total Project Appropriations	5,014,559	690,000	690,000	740,178	5,128,263	12,263,000

The following table breaks out estimated costs by Subproject:

($ thousands)

WTP Project	Prior	FY09	FY10	FY11	Outyears	Total
Low-Activity	1,139,794	116,198	122,719	67,459	637,830	2,084,000
Analytical Lab	260,221	60,455	36,961	21,601	410,762	790,000
Bal of Facilities	489,461	55,531	42,331	51,198	571,479	1,210,000
High-Level	1,118,117	202,998	239,707	197,090	1,482,088	3,240,000
Pretreatment	1,660,626	303,805	362,286	402,439	2,209,844	4,939,000
Total Project Costs	4,668,219	738,987	804,004	739,787	5,312,003	12,263,000

The following tables provide a breakdown of planned spending for engineering, procurement, construction, and commissioning for each facility for FY 2010 and FY 2011.

Planned Spend for FY 2010 (dollars in thousands)

Facility	Engineering	Procurement	Construction	Commissioning	Total
Low-Activity Waste	39,448	26,990	52,505	3,776	122,719
Analytical Laboratory	7,754	10,708	15,955	2,544	36,961
Balance of Facilities	10,748	4,431	25,550	1,602	42,331
High-Level Waste	42,873	104,809	85,226	6,800	239,707
Pretreatment	86,890	155,367	109,124	10,905	362,286
Total	187,712	302,305	288,359	25,627	804,004

Planned Spend for FY 2011 (dollars in thousands)

Facility	Engineering	Procurement	Construction	Commissioning	Total
Low-Activity Waste	11,315	13,194	39,693	3,257	67,459
Analytical Laboratory	7,840	1,384	10,259	2,118	21,601
Balance of Facilities	10,122	14,752	21,757	4,568	51,198
High-Level Waste	30,963	64,806	92,409	8,912	197,090
Pretreatment	76,764	195,015	114,199	16,461	402,439
Total	137,004	289,150	278,317	35,316	739,787

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	2,547,977	2,493,233	1,475,000
Equipment/Procurement[1]	2,380,748	2,443,355	1,125,000
Facility Construction[2]	3,720,637	3,714,187	2,155,000
Commissioning[3]	1,409,428	1,360,225	876,000
Technical Support/Transition	185,000	185,000	50,000
Contingency/Fee[4]	2,019,210	2,067,000	100,000
Total, Construction	12,263,000	12,263,000	5,781,000
Total, TEC	12,263,000	12,263,000	5,781,000
Contingency, TEC	[2,019,210]	[2,067,000]	[100,000]
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	12,263,000	12,263,000	5,781,000
Total, Contingency	[2,019,210]	[2,067,000]	[100,000]

Note: The dollars above may not necessarily match the dollar values in the Section 1 tables, as the dollars in the table above represent financial actuals through FY 2008 and the anticipated spend through FY 2020, and the Section 1 tables are based on Earned Value Management values. Most of the delta in values is related to accruals for equipment purchase orders.

1. Equipment/Procurement dollars represent costs of plant equipment, bulk plant material, and acquisition services.
2. Facility Construction dollars represent construction costs through system turnover.
3. Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.
4. Contingency/Fee dollars represent the contractor's Management Reserve, Total Available Fee, and DOE Project Contingency.

7. Funding Profile History

		($K)								
Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2002	TEC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
FY 2003	TEC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
FY 2004	TEC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	4,350,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4,350,000
FY 2005	TEC	5,781,000	0	0	0	0	0	0	0	5,781,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,781,000	0	0	0	0	0	0	0	5,781,000
FY 2006	TEC	5,354,720	339,152	87,128	0	0	0	0	0	5,781,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,354,720	339,152	87,128	0	0	0	0	0	5,781,000
FY 2007	TEC	5,343,618	339,152	98,230	0	0	0	0	0	5,781,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,343,618	339,152	98,230	0	0	0	0	0	5,781,000
FY 2008 Performance Baseline	TEC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
FY 2009	TEC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
FY 2010	TEC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,704,559	690,000	690,000	690,000	690,000	690,000	690,000	2,418,441	12,263,000
FY 2011	TEC	5,704,559	690,000	740,178	690,000	690,000	690,000	690,000	2,368,263	12,263,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	5,704,559	690,000	740,178	690,000	690,000	690,000	690,000	2,368,263	12,263,000

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2020
Expected Useful Life (number of years)	40
Expected Future Start of D&D of this capital asset (fiscal quarter)	TBD

(Related Funding requirements)

(Dollars in Thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
N/A	N/A	N/A	N/A	N/A

Operations will start after the project is completed in November 2019. The annual facility operating costs for the Waste Treatment and Immobilization Plant (following start-up and commissioning) and subsequent Decommissioning and Demolition are not included in this line item project or in the five subprojects. These costs are included in PBS ORP-0014, Office of River Protection - Radioactive Liquid Tank Waste Stabilization and Disposition project, and are therefore not included in this Construction Project Data Sheet.

9. Required D&D Information

Area	Square Feet

This project is providing new capability for the Hanford site, and is not replacing a current capability. Thus, this project was not justified on the basis of replacing current facilities. Therefore, no existing facilities will be demolished in conjunction with this project.

10. Acquisition Approach

The acquisition of a waste treatment facility to treat Hanford waste was initially planned as a privatized procurement and the project was referred to as the Tank Waste Remediation System. The strategy was for the contractor to design, build, finance, and operate the facility for 10 years and the Department would pay for waste processed. Two privatization contracts were signed in September 1996 for the preparation of conceptual designs: (1) a subsidiary of BNFL plc, with Bechtel National, Incorporated as a subcontractor, and (2) Lockheed-Martin. In May 1998, BNFL, Incorporated was authorized to proceed with preliminary design. Construction was scheduled to commence in December 2000 and hot operations were to start in December 2007, to treat approximately 10 percent of the tank waste (by mass) and 25 percent of the tank waste radioactivity inventory. This plant was expected to have a 40 year operational life and would process a total of 40 percent of the waste by volume. A second plant would be necessary to treat and immobilize the balance of the waste. Planning associated with this privatization contract completed the following Critical Decision milestones:

1. Critical Decision - 0: Approved Mission Need - September 1995
2. Critical Decision - 1: Approved Preliminary Baseline Range - September 1996
3. Critical Decision - 2: Approved Performance Baseline - August 1998

In May 2000, the Secretary of Energy terminated the privatization contract, because of the dramatic cost increase submitted by the contractor to complete the project. In December 2000, the Department awarded a Cost-Plus Incentive-Fee contract estimated at $4,350,000,000 to design, construct and commission the Waste Treatment and Immobilization Plant. In April 2003, a contract modification was negotiated with the principal change being to cover increasing the through-put capacity of the Pretreatment and High-Level Waste Facilities, with the goal of pretreating all of the waste during the 40 year life of the facility, immobilizing all high-level fraction and at least 40 percent of the low-activity fraction. The Department approved a Performance Baseline with a Total Project Cost of $5,781,000,000. In December 2006, the Department approved a new Performance Baseline with a revised Total Project Cost of $12,263,000,000.

The project is being executed in accordance with the project management requirements in DOE Order 413.3A and DOE Manual 413.3-1, *Program and Project Management for the Acquisition of Capital Assets*. The following critical decisions were approved after the December 2000 award:

1. Critical Decision - 3A: Approved Limited Construction - October 2001
2. Critical Decision - 3B: Approved Preliminary Construction - May 2002

3. Critical Decision - 3C: Approved Full Construction - April 2003
4. Approval of Revised Cost and Schedule Baseline - December 2006

The following critical decision is planned for the future.

1. Critical Decision - 4: Approved Start of Operation - 1Q FY 2020
   (Based on completion of hot commissioning by July 30, 2019, and transition of operations to the Tank Operations Contractor by November 30, 2019.)

The contractual milestone dates shown below are based on the recently executed, revised contract with the Waste Treatment and Immobilization Plant contractor. The River Protection Project regulatory pathway for cleanup has been provided in the past primarily by the Hanford Federal Facility Agreement and Consent Order, commonly known as the Tri-Party Agreement. On August 11, 2009, the Department of Energy and the Washington State Department of Ecology announced tentative agreement on a proposed judicial consent decree for retrieval of certain single-shell tanks and construction and initial operation of the Waste Treatment and Immobilization Plant as well as proposed and modified milestones under the Tri-Party Agreement for retrieval of the remaining single-shell tanks, closure of single-shell tanks and double-shell tanks, and treatment of all tank wastes. Some significant milestones under these proposals include achieving initial operations of the Waste Treatment and Immobilization Plant in 2019 (from 2011), completing retrieval of wastes from single-shell tanks by 2040 (from 2018), and completing pretreatment processing and vitrification of Hanford high-level waste and low activity tank wastes by 2047 (from 2028).

Waste Treatment and Immobilization Plant Milestones

WTP Project Milestone Description	Schedule Date
Start of Construction	July 10, 2002 A
Start Cold Commissioning*	September 30, 2017
Completion of Hot Commissioning*	July 30, 2019
Completion of Contract Requirements	November 30, 2019
* Contract Dates - January 2009 Revision	

Note: The planned dates represent the contract dates and may differ from dates displayed in Section 2, which are the DOE Critical Decision approval dates.

01-D-16A, Low-Activity Waste Facility, Hanford, WA Project Data Sheet is for Construction

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decision for the overall Waste Treatment and Immobilization Plant Project is Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. The latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments included with this Construction Project Data Sheet are based on March 2009 project data.

The current Total Project Cost for the Low-Activity Waste Facility is $2,084,000,000. Facility milestone dates are consistent with the revised January 2009 contract.

A Federal Sub-Project Director with a current level II certification has been assigned to the Low-Activity Waste Facility, per the DOE Project Management Career Development Program.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008	4Q FY1995	4Q FY1996	4Q FY2008	3Q FY2003	3Q FY2003	2Q FY2012	N/A	N/A
FY 2009	4Q FY1995	4Q FY1996	3Q FY2009	3Q FY2003	3Q FY2003	1Q FY2014	N/A	N/A
FY 2010	4Q FY1995	4Q FY1996	4Q FY2011	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011	4Q FY1995	4Q FY1996	4Q FY2011	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:

1) The FY 2009 Budget Request 'PED Complete' date is based on the June 2007 Execution Revision schedule.
2) The FY 2008 Budget Request date for 'CD-4' of 2Q FY 2012 represented the completion of physical construction of the facility. In the FY 2009 Budget Request the 'CD-4' completion date represents the completion of construction, start-up, commissioning, and the transfer of the facility to the operations contractor (based on the Early LAW concept).
3) The FY 2010 Budget Request 'PED Complete' and 'CD-4' dates are from the revised contract signed January 2009, and the 'CD-4' date now represents the completion of construction, start-up, commissioning and the transfer of the WTP Project to the operations contractor.

The Mission Need (Critical Decision - 0) for the Waste Treatment and Immobilization Plant Project was approved in September 1995, followed by Critical Decision - 1 in September 1996, and Critical Decision - 2 in August 1998. The Waste Treatment and Immobilization Plant Project was initiated as a privatization contract in 1998, and then was re-bid to a conventional cost reimbursable type contract in December 2000. In May 2002, Critical Decision - 3b - Preliminary Construction - was approved, which authorized basemat concrete and concrete walls to grade, and allowed the first concrete placement for the Low-Activity Waste Facility in July 2002. In April 2003, a revised Performance Baseline (Critical Decision - 2) and Full Construction Authorization (Critical Decision - 3c) were formally approved for the Waste Treatment and Immobilization Plant Project.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	0	1,060,740	1,060,740	0	0	0	1,060,740
FY 2008	0	1,748,000	1,748,000	0	0	0	1,748,000
FY 2009	0	1,748,000	1,748,000	0	0	0	1,748,000
FY 2010	0	2,084,000	2,084,000	0	0	0	2,084,000
FY 2011	0	2,084,000	2,084,000	0	0	0	2,084,000

Note: FY 2007 budget submittal values above did not include the facility costs prior to FY 2006. These prior year costs (FY 2001 - FY 2005, included in Line Item 01-D-416) were added to the FY 2008 budget submittal values to provide the total estimated cost for the facility.

A revised Performance Baseline for the overall Waste Treatment and Immobilization Plant Project was validated and approved on December 22, 2006, with a Total Project Cost of $12,263,000,000. The estimated Low-Activity Waste Facility portion of the current Total Project Cost is now $2,084,000,000.

4. Project Description, Justification, and Scope

The Low-Activity Waste Facility is an integral part of the tank waste cleanup project. The facility is a seven-story concrete and steel framed building that covers an area one football field long by one-and-a-half football fields wide. It is constructed from 28,000 cubic yards of concrete and 6,000 tons of structural steel, includes 19 miles of piping. The low-activity waste will be mixed with glass formers, converted to glass, and placed in stainless steel canisters (7 feet high, 4 feet in diameter), which will be disposed in the on-site Integrated Disposal Facility. The facility utilizes two melters that have a combined design capacity (name plate) and combined treatment capacity (at 70 percent plant availability) of 30 metric tons and 21 metric tons, respectively, of glass per day. The facility is designed for contact maintenance, as the melters are self-shielded. An annex abutting the facility will provide control rooms, entries, and operations and maintenance support areas.

FY 2009 Accomplishments

Design Activities:

- Continued to move design toward completion, with the following significant achievements:
  - Completed Title II Design and Engineering activities (those activities that would support a bid for construction and procurements had the project been administered in the manner of a design-bid-build project).

Procurement Activities:

- Received both glass former mixers.
- Received the melter off gas spools within the process cells including the concrete wall boxes.
- Received the melter power supply equipment.

Construction Activities:

- Completed installation of the roof and wall stainless steel liner plated in melter #1 and #2 pour caves.
- Completed structural steel erection on the receiving dock.
- Completed rough setting both glass former mixers on the roof of the facility.
- Continued installation of piping, hangers, and other commodities.

FY 2010 Activities

Design Activities:

- Continue to move design toward completion, with the following significant achievements:
  - Issue remaining fabrication piping isometrics and engineered pipe support drawings.
  - Issue system logic diagrams.
  - Revise/update melter design drawings.
  - Issue Low Activity Waste facility Waste Qualification Report.

Procurement Activities:

- Receive the off gas mercury adsorber.
- Complete fabrication for Melter 1 and Melter 2 lid and balance of components.
- Award purchase order for the Secondary Offgas/Vessel Vent Process System off gas high integrity centrifugal exhausters and thermal catalytic oxidizer.

Construction Activities:

- Continue installation of piping, hangers, and other commodities, with the following significant achievements:
  - Complete Switchgear Building erection which includes structural steel erection, siding & roofing installation and building utility installation (electrical commodities and eating/ventilation/cooling).
  - Complete staging six exhaust high-efficiency particulate air filter housings on the 48-foot elevation (third floor).
  - Initiate construction installation for off gas wall boxes and off gas spools on the process cells.

FY 2011 Activities

Design Activities:

- Continue to move design toward completion, with the following significant achievements:
  - Complete mechanical system confirmed calculations and Process and Instrumentation Diagram drawings.
  - Complete plant design confirmed stress/support final calculations.

Procurement Activities:

- Maintain backlog of materials supporting construction, with the following significant achievements:
  - Receive and accept the melter off gas catalytic oxidizer.
  - Receive and accept the melter off gas high-efficiency particulate air pre-heaters.
  - Complete Research and Technology closure reports.

Construction Activities:

- Continue installation of piping, hangers, and other commodities, with the following significant achievements:
  - Complete rough setting the melter off gas catalytic oxidizer.
  - Complete approximately 80 percent of bulk process piping installation.
  - Complete approximately 65 percent of bulk conduit installation.

The following table provides the status for each phase by the end of each fiscal year: accomplished for FY 2009, planned for FY 2010, and proposed for FY 2011.

Phase	FY 2009	FY 2010	FY 2011
Design	92%	96%	97%
Procurement	80%	91%	94%
Construction	62%	71%	77%
Commissioning	4%	4%	5%
Overall Facility [a]	67%	73%	77%

[a] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2005[a]	668,124	668,124	585,620
FY 2006	161,376	161,376	172,147
FY 2007	186,000	186,000	187,749
FY 2008	141,699	141,699	194,278
FY 2009	160,000	160,000	116,198
FY 2010	100,000	100,000	122,719
FY 2011	57,500	57,500	67,459
FY 2012	65,000	65,000	63,654
FY 2013	50,000	50,000	52,227
FY 2014	60,000	60,000	62,758
FY 2015	56,500	56,500	68,753
FY 2016	105,000	105,000	93,398
FY 2017	100,000	100,000	94,021
FY 2018	90,000	90,000	99,786
FY 2019	82,801	82,801	55,531
FY 2020	-	-	47,702
Total, Construction	2,084,000	2,084,000	2,084,000

Notes:

[a] The FY 2005 line is based on facility costs prior to the split of the WTP into the five facilities.

The following table provides a breakdown of planned spending by design, procurement, construction, and commissioning for the next few fiscal years (in thousand of dollars):

Phase	FY 2009	FY 2010	FY 2011
Design	32,484	39,448	11,315
Procurement	27,401	26,990	13,194
Construction	53,141	52,505	39,693
Commissioning	3,172	3,776	3,257
Total Facility	116,198	122,719	67,459

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	485,579	471,435	n/a
Equipment/Procurement[a]	422,494	433,122	n/a
Facility Construction[b]	617,131	644,084	1,175,000
Commissioning[c]	248,324	262,359	n/a
Technical Support/Transition	32,748	33,000	n/a
Contingency/Fee[d]	277,724	240,000	n/a
Total, Construction	2,084,000	2,084,000	1,175,000
Total, TEC	2,084,000	2,084,000	1,175,000
Contingency, TEC	[277,724]	[240,000]	n/a
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	2,084,000	2,084,000	1,175,000
Total, Contingency	[277,724]	[240,000]	n/a

Notes:

[a] Equipment/Procurement dollars represent of costs of plant equipment, plant material, and Acquisition Services.

[b] Facility Construction dollars represent construction costs through system turnover.

[c] Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.

[d] Contingency/Fee represents the contractor's Management Reserve, Fee, and DOE Project Contingency.

[e] The value listed in the "Original Validated Baseline - Facility Construction" is a total number for all the values that would normally appear in this column. A breakout for the March 2003 Baseline is not available, as until FY 2006 the facilities were not separated but totaled for the whole project, and the current breakout methodology was implemented in FY 2008.

7. Funding Profile History

Request		($K)								
		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2008 Performance Baseline	TEC	1,317,199	80,000	75,000	51,000	45,000	30,000	25,000	124,801	1,748,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,317,199	80,000	75,000	51,000	45,000	30,000	25,000	124,801	1,748,000
FY 2009	TEC	1,317,199	100,000	55,000	85,000	45,000	30,000	25,000	90,801	1,748,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,317,199	100,000	55,000	85,000	45,000	30,000	25,000	90,801	1,748,000
FY 2010	TEC	1,317,199	100,000	60,000	75,000	55,000	50,000	70,000	356,801	2,084,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,317,199	100,000	60,000	75,000	55,000	50,000	70,000	356,801	2,084,000
FY 2011	TEC	1,317,199	100,000	57,500	65,000	50,000	60,000	56,500	377,801	2,084,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,317,199	100,000	57,500	65,000	50,000	60,000	56,500	377,801	2,084,000

8. Related Operations and Maintenance Funding Requirements

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

9. Required D&D Information

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

10. Acquisition Approach

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

The following facility milestone dates are based on the contractor's December 2008 Internal Replan and revised contract signed in January 2009.

Low-Activity Waste Facility Milestones

Milestone Title	Milestones - January 2009
Start Construction	July 10, 2002 A
Complete Design	September 30, 2011
Substantially Complete Construction*	December 31, 2014
Complete Construction	June 2015
Start Cold Commissioning*	February 28, 2018
Complete Hot Commissioning*	May 30, 2019
A = Actual date construction started which followed approval of CD-3B. * Contract Milestones-January 2009 Contract	

Note: The final Low-Activity Waste Facility Construction Complete milestone is June 2015. After construction and in preparation of Cold Commissioning, component and system testing will be conducted on 11 process systems as well as operator training.

01-D-16B, Analytical Laboratory, Hanford, WA Project Data Sheet is for Construction

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decision for the overall Waste Treatment and Immobilization Plant Project is Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. The latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments included with this Construction Project Data Sheet are based on March 2009 project data.

The current Total Project Cost for the Analytical Laboratory is $790,000,000. Facility milestone dates are consistent with the revised January 2009 contract.

A Federal Sub-Project Director with a current level II certification has been assigned to the Analytical Laboratory, per the DOE Project Management Career Development Program.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008	4Q FY1995	4Q FY1996	4Q FY2009	3Q FY2003	3Q FY2003	1Q FY2011	N/A	N/A
FY 2009	4Q FY1995	4Q FY1996	1Q FY2010	3Q FY2003	3Q FY2003	1Q FY2014	N/A	N/A
FY 2010	4Q FY1995	4Q FY1996	4Q FY2012	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011	4Q FY1995	4Q FY1996	4Q FY2012	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:

1) The FY 2009 Budget Request 'PED Complete' date is based on the June 2007 Execution Revision schedule.
2) The FY 2008 Budget Request date for 'CD-4' of 1Q FY 2011 represented the completion of physical construction of the facility. In the FY 2009 Budget Request, the 'CD-4' completion date represents the completion of construction, start-up, commissioning and the transfer of the laboratory to the operations contractor (based on the Early Law concept).
3) The FY 2010 Budget Request 'PED Complete' and 'CD-4' dates are from the revised contract signed January 2009, and the 'CD-4' date now represents the completion of construction, start-up, commissioning and the transfer of the WTP Project to the operations contractor.

The Mission Need (Critical Decision-0) for the Waste Treatment and Immobilization Plant Project was approved in September 1995, followed by Critical Decision - 1 in September 1996, and Critical

Decision - 2 in August 1998. The Waste Treatment and Immobilization Plant Project was initiated as a privatization contract in 1998, and then was re-bid to a conventional cost reimbursable type contract in December 2000. In May 2002, Critical Decision - 3b - Preliminary Construction - was approved, which authorized basemat concrete and concrete walls to grade. In April 2003, a revised Performance Baseline (Critical Decision - 2) and Full Construction Authorization (Critical Decision - 3c) were formally approved for the Waste Treatment and Immobilization Plant Project. The first concrete placement for the Analytical Laboratory was in July 2004.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	0	267,140	267,140	0	0	0	267,140
FY 2008	0	676,000	676,000	0	0	0	676,000
FY 2009	0	676,000	676,000	0	0	0	676,000
FY 2010	0	790,000	790,000	0	0	0	790,000
FY 2011	0	790,000	790,000	0	0	0	790,000

Note: FY 2007 budget submittal values above did not include the facility costs prior to FY 2006. These prior year costs (FY 2001 - FY 2005, included in Line Item 01-D-416) were added to the FY 2008 budget submittal values to provide the total estimated cost for the facility.

A revised Performance Baseline for the overall Waste Treatment and Immobilization Plant Project was validated and approved on December 22, 2006, with a Total Project Cost of $12,263,000,000. The estimated Analytical Laboratory portion of the current Total Project Cost is $790,000,000.

4. Project Description, Justification, and Scope

The Analytical Laboratory is a vital production link that drives waste vitrification process control and waste form qualification for the main production facilities, i.e., Pretreatment, High-Level Waste and Low-Activity Waste facilities. The facility is a four-story building that covers an area about the size of one football field, with a building volume of over 2.5 million cubic feet. Overall construction will include 12,000 cubic yards of concrete, 1,700 tons of structural steel, and 7 miles of piping. The Lab's importance centers on its around-the-clock ability to analyze waste samples from the Pretreatment Facility, as well as from the two vitrification facilities, with its key function being to ensure the final glass product meets all regulatory requirements and standards. Nearly 10,000 waste samples per year will be analyzed in the Analytical Laboratory.

The Laboratory will incorporate features and capabilities necessary to ensure efficient operations including: (1) receipt/handling of Hanford Tank Farm samples for waste feed acceptance, (2) process control, (3) waste form qualification testing, (4) environmental and authorization basis compliance, and (5) limited technology testing. The Laboratory contains eight main areas: (1) administrative areas, (2) 14 radiological laboratories which house fume hoods and related equipment to support low-activity sample analysis activities, (3) 14 hot cells that house equipment necessary for high-activity waste analysis activities, (4) maintenance and decontamination areas that house tools and equipment necessary to support facility maintenance and operations, (5) mechanical and utility areas house equipment that provide ventilation, electricity, laboratory gases, and water supplies, (6) below grade Radioactive Liquid Waste Disposal system cells and pits house vessels and equipment for handling effluents from the processes and operations of the lab, (7) two bulk storage tanks - one tank contains liquid nitrogen and the other holds liquid argon which supports lab operations, and (8) pressurized helium bottle storage area.

FY 2009 Accomplishments:

Design Activities:

- Continued to move design toward completion, with the following significant achievements:
  - Completed Title II Design and Engineering activities (those activities that would support a bid for construction and procurements had the project been administered in the manner of a design-bid-build project).

Procurement Activities:

- Maintained a backlog of materials supporting construction, with the following significant achievements:
  - Received eight C5 safe change High Efficiency Particulate Air filter housings.
  - Received the mechanical handling hot cell equipment.

Construction Activities:

- Continued installation of piping, hangers, and other commodities, with the following significant achievements:
  - Completed approximately 55 percent of heating ventilation and air conditioning duct and support installation.
  - Completed formwork, rebar, embed, concrete placement for the hot cell north end wall.

Planned FY 2010 Activities:

Design Activities:

- Continue to move design toward completion, with the following significant achievements:
  - Complete mechanical system confirmed calculations and process and instrumentation diagrams.

Procurement Activities:

- Maintain backlog of materials supporting construction, with the following significant achievements:
  - Receive the waste transfer system equipment.
  - Receive autosampler equipment including sample delivery equipment for the hot cell, fume hoods and receipt docking stations.
  - Receive two axial filter housings.

Construction Activities:

- Continue installation of piping, hangers, and other commodities, with the following significant achievements:
  - Complete formwork, reinforcing bar, embeds, and concrete placement for elevated slab over the C5 pit.
  - Complete approximately 90 percent of heating ventilation and air conditioning duct and support installation.

Planned FY 2011 Activities:

Construction Activities:

- Complete approximately 90 percent of bulk piping installation.
- Complete approximately 70 percent of bulk conduit installation.

- Complete installation of Heating Ventilation and Air Conditioning equipment on the second floor, northwest corner.

The following table provides the status for each phase by the end of each fiscal year: accomplished for FY 2009, planned for FY 2010, and proposed for FY 2011.

Phase	FY 2009	FY 2010	FY 2011
Design	79%	85%	86%
Procurement	74%	80%	81%
Construction	60%	69%	79%
Commissioning	7%	8%	8%
Overall [a]	48%	53%	56%

[a] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2005[a]	125,948	125,948	116,790
FY 2006	44,552	44,552	25,966
FY 2007	59,000	59,000	62,975
FY 2008	44,590	44,590	54,490
FY 2009	65,000	65,000	60,455
FY 2010	55,000	55,000	36,961
FY 2011	2,500	2,500	21,601
FY 2012	25,000	25,000	25,927
FY 2013	35,000	35,000	35,427
FY 2014	30,000	30,000	35,538
FY 2015	56,000	56,000	58,101
FY 2016	70,000	70,000	63,095
FY 2017	85,000	85,000	78,835
FY 2018	75,000	75,000	86,843
FY 2019	17,410	17,410	23,828
FY 2020	-	-	3,168
Total, Construction	790,000	790,000	790,000

[a] The FY2005 line is based on facility costs prior the split of the WTP into the five facilities

The following table provides a breakdown of current and planned spending by design, procurement, construction, and commissioning for the next few fiscal years (in thousand of dollars):

Phase	FY 2009	FY 2010	FY 2011
Design	17,735	7,754	7,840
Procurement	11,180	10,708	1,384
Construction	28,367	15,955	10,259
Commissioning	3,173	2,544	2,118
Total	60,455	36,961	21,601

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	116,118	108,000	n/a
Equipment/Procurement [a]	109,274	106,500	n/a
Facility Construction [b]	148,744	162,000	426,000
Commissioning [c]	249,389	243,500	n/a
Technical Support/Transition	14,549	19,300	n/a
Contingency/Fee [d]	151,926	150,700	n/a
Total, Construction	790,000	790,000	426,000
Total, TEC	790,000	790,000	426,000
Contingency, TEC	[151,926]	[150,700]	n/a
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	790,000	790,000	426,000
Total, Contingency	[151,926]	[150,700]	n/a

Notes:

[a] Equipment/Procurement dollars represent of costs of plant equipment, plant material, and Acquisition Services.

[b] Facility Construction dollars represent construction costs through system turnover.

[c] Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.

[d] Contingency/Fee represents the contractor's Management Reserve, Fee, and DOE Project Contingency.

[e] The value listed in the "Original Validated Baseline - Facility Construction" is a total number for all the values that would normally appear in this column. A breakout for the March 2003 Baseline is not available, as until FY 2006 the facilities were not separated but totaled for the whole project, and the current breakout methodology was implemented in FY 2008.

7. Funding Profile History

Request		($K)								
		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2008 Performance Baseline	TEC	339,090	40,000	20,000	39,000	20,000	20,000	25,000	172,910	676,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	339,090	40,000	20,000	39,000	20,000	20,000	25,000	172,910	676,000
FY 2009	TEC	339,090	60,000	30,000	45,000	20,000	20,000	25,000	136,910	676,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	339,090	60,000	30,000	45,000	20,000	20,000	25,000	136,910	676,000
FY 2010	TEC	339,090	55,000	5,000	10,000	35,000	35,000	45,000	265,910	790,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	339,090	55,000	5,000	10,000	35,000	35,000	45,000	265,910	790,000
FY 2011	TEC	339,090	55,000	2,500	25,000	35,000	30,000	35,000	268,410	790,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	339,090	55,000	2,500	25,000	35,000	30,000	35,000	268,410	790,000

8. Related Operations and Maintenance Funding Requirements

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

9. Required D&D Information

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

10. Acquisition Approach

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

The following facility milestone dates are based on the contractor's December 2008 Internal Replan and revised contract signed in January 2009.

Analytical Laboratory Milestones

Milestone Title	Milestones - January 2009
Start Construction	August 2, 2004 A
Complete Design	September 30, 2012
Substantially Complete Construction*	December 31, 2012
Complete Construction	June 30, 2014
A=Actual date construction started which followed approval of CD-3C * Contract Milestones-January 2009 Contract	

01-D-16C, Balance of Facilities, Hanford, WA

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decision for the overall Waste Treatment and Immobilization Plant Project is Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. The latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments included with this Construction Project Data Sheet are based on March 2009 project data.

The current Total Project Cost for the Balance of Facilities is $1,210,000,000. Facility milestone dates are consistent with the revised January 2009 contract.

A Federal Sub-Project Director with a current level II certification has been assigned to the Balance of Facilities per the DOE Project Management Career Development Program.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008	4Q FY1995	4Q FY1996	4Q FY2009	3Q FY2003	3Q FY2003	2Q FY2012	N/A	N/A
FY 2009	4Q FY1995	4Q FY1996	4Q FY2011	3Q FY2003	3Q FY2003	1Q FY2014	N/A	N/A
FY 2010	4Q FY1995	4Q FY1996	1Q FY2015	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011	4Q FY1995	4Q FY1996	1Q FY2015	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:

1. The FY 2009 Budget Request date for 'PED Complete' is based on the June 2007 Execution Revision schedule.
2. The FY 2008 Budget Request date for 'CD-4' of 2Q FY 2012 represented the completion of physical construction of the facility. In the FY 2009 Budget Request, the 'CD-4' date represents the completion of construction, start-up, commissioning, and the transfer of the Balance of Facilities to the operations contractor (based on the Early LAW concept).
3. The FY 2010 Budget Request 'PED Complete' and 'CD-4' dates are from the revised contract signed January 2009, and the 'CD-4' date now represents the completion of construction, start-up, commissioning and the transfer of the WTP Project to the operations contractor.

The Mission Need (Critical Decision - 0) for the Waste Treatment and Immobilization Plant Project was approved in September 1995, followed by Critical Decision - 1 in September 1996, and Critical Decision - 2 in August 1998. The Waste Treatment and Immobilization Plant Project was initiated as a privatization contract in 1998, and then was re-bid to a conventional cost reimbursable type contract in December 2000. In October 2001, Critical Decision - 3a - Limited Construction - was approved, which authorized site work and utilities. In April 2003, a revised Performance Baseline (Critical Decision - 2) and Full Construction Authorization (Critical Decision - 3c) were formally approved for the Waste Treatment and Immobilization Plant Project.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	0	596,741	596,741	0	0	0	596,741
FY 2008	0	1,137,000	1,137,000	0	0	0	1,137,000
FY 2009	0	1,137,000	1,137,000	0	0	0	1,137,000
FY 2010	0	1,210,000	1,210,000	0	0	0	1,210,000
FY 2011	0	1,210,000	1,210,000	0	0	0	1,210,000

Note: FY 2007 budget submittal values above did not include the facility costs prior to FY 2006. These prior year costs (FY 2001 - FY 2005, included in Line Item 01-D-416) were added to the FY 2008 budget submittal values to provide the total estimated cost for the facility.

A revised Performance Baseline for the overall Waste Treatment and Immobilization Plant Project was validated and approved on December 22, 2006, with a Total Project Cost of $12,263,000,000. The estimated Balance of Facilities portion of the current Total Project Cost is $1,210,000,000.

4. Project Description, Justification, and Scope

The Balance of Facilities comprises 20 support buildings (165,000 square feet in footprint) and approximately 100 systems across the 65-acre plant site, providing interconnecting utilities and support to the Pretreatment, High-Level Waste, and Low-Activity Waste facilities and to the Analytical Laboratory. The Balance of Facility construction entails 900 tons of structural steel, 17,000 cubic yards of concrete, 30 miles of piping, 110 miles of electrical cable, and over 2.3 million cubic yards of earthwork. While not directly involved with the processing or vitrification of radiological material, these facilities make up the overall services infrastructure essential to operation of the plant.

The Balance of Facilities infrastructure and facilities are comprised of the following groups: power, steam, water, air, process support, waste facilities, and miscellaneous support buildings. The power group consists of three switchgear buildings and two diesel generator facilities. The steam group consists of a steam plant and a fuel oil facility. The water group consists of cooling towers, water treatment facility, chiller/compressor facility, and the firewater facility. The air group is made up of the compressors. The process support group consists of the glass former storage facility, wet chemical storage facility, and the anhydrous ammonia storage facility. The waste facilities group consists of the spent melter staging pad, failed melter storage facility, and the non-dangerous, non-radioactive effluent facility. The miscellaneous support buildings group includes the administration building, simulator facility, warehouse, and site infrastructure (roads, grading, lights, sanitary waste, storm drains, etc.).

FY 2009 Accomplishments:

Design Activities:

- Continued to move design toward completion, with the following significant achievements:
  - Issued for construction the building foundation design for Glass Former Control Building.
  - Issued fabrication piping isometrics and pipe support drawings for Anhydrous Ammonia Facility.

Procurement Activities:

- Maintained backlog of materials supporting construction, with the following significant achievements:
  - Awarded the purchase order for the anhydrous ammonia vaporizers skids.

Construction Activities:

- Continued installation of piping, hangers, and other commodities, with the following significant achievements:

The following table provides design and site construction status for the overall Balance of Facilities grouping; including, progress specific to individual facilities and work that supports multiple facilities. The "Balance of Facilities common scope" listed here comprises mostly design work that is common to the facilities; "site work" consists of the general earthwork and utilities across the Waste Treatment and Immobilization Plant construction site and between facilities, and is not associated with a particular facility.

Facility	Engineering % Complete Nov 09	Construction % Complete Nov 09	Scheduled Completion Date
Guard House Facility	100.0%	100.0%	Complete
Erected Tanks – Process/Potable	100.0%	100.0%	Complete
Maintenance Shop	100.0%	100.0%	Complete
Warehouse Building	100.0%	100.0%	Complete
Fire Water Pump House Facility	100.0%	100.0%	Complete
Steam Plant Facility	100.0%	99.1%	Oct 2012
Balance of Facilities Switchgear Building	97.1%	89.4%	Jul 2010
Cooling Tower Facility	100.0%	99.5%	Mar 2010
Water Treatment Building	100.0%	79.6%	Jul 2010
Fuel Oil Facility	100.0%	95.9%	Apr 2010
Anhydrous Ammonia	90.2%	0.5%	Dec 2012
Chiller Compressor Plant	99.7%	93.6%	Mar 2012
Non-Dangerous, Non-Radioactive Effluent Facility	98.4%	86.6%	Apr 2012
Glass Former Storage Facility	96.9%	33.5%	Aug 2012
Failed Melter Storage Facility	14.1%	2.4%	Jun 2013
Switchgear Building	98.1%	89.2%	Jun 2011
Administration Building	23.9%	0.0%	Mar 2014
Simulator Facility	100.0%	77.4%	Mar 2014
Wet Chemical Storage Facility	68.4%	0.0%	Sep 2014
Diesel Generators Facility	54.1%	0.0%	Oct 2015

Note: The percentages of completion have been adjusted to reflect a replan of the baseline, which may have resulted in lower percentages of completions than previously reported.

Planned FY 2010 Activities:

Design Activities:

- Continue to move design toward completion, with the following significant achievements:
  - Complete Title II mechanical handling design (those activities that would support a bid for construction and procurements had the project been administered in the manner of a design-bid-build project).
  - Issue for construction slab and wall foundation design for wet chemical storage facility.

Procurement Activities:

- Maintain backlog of materials supporting construction, with the following significant achievements:
  - Deliver two leak detection boxes.
  - Deliver two diesel fuel tanks.

Construction Activities:

- Complete construction of the Water Treatment Building.
- Complete installation of the cathodic protection system (scope to support the early temporary system energization for underground pipe protection).

Planned FY 2011 Activities:

Procurement Activities:

- Award purchase order on 4.16kV emergency diesel generator.
- Receive and accept the anhydrous ammonia system.

The following table provides the status for each phase by the end of each fiscal year: accomplished for FY 2009, planned for FY 2010, and proposed for FY 2011.

Phase	FY 2009	FY 2010	FY 2011
Design	77%	85%	90%
Procurement	42%	44%	54%
Construction	64%	68%	72%
Commissioning	11%	12%	13%
Overall [a]	52%	55%	59%

[a] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs.

The project is being conducted in accordance with the project management requirements in DOE O 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2005[a]	330,148	330,148	330,080
FY 2006	64,352	64,352	41,610
FY 2007[b]	57,000	51,300	54,573
FY 2008[c]	71,345	77,045	63,198
FY 2009	75,000	75,000	55,531
FY 2010	50,000	50,000	42,331
FY 2011	5,000	5,000	51,198
FY 2012	55,000	55,000	55,087
FY 2013	70,000	70,000	68,455
FY 2014	105,000	105,000	112,232
FY 2015	82,500	82,500	90,869
FY 2016	90,000	90,000	83,573
FY 2017	65,000	65,000	57,740
FY 2018	55,000	55,000	62,192
FY 2019	34,655	34,655	32,099
FY 2020	-	-	9,232
Total, Construction	1,210,000	1,210,000	1,210,000

[a] The prior year appropriations and obligation have been updated to reflect a more current estimate of the anticipated utilization of the non-facility specific carryover funding remaining in the WTP line item 01-D-416. The FY 2005 line is based on facility costs prior the split of the WTP into the five facilities.
[b] 10 percent of the FY 2007 Appropriation has been held back as a result of not achieving Secretarial certification of the contractor's Earned Value Management System by September 30, 2007. The certification was received in FY 2008, at which time the $69,000,000 will be obligated to the project. Balance of Facilities portion of the hold-back is $5,700,000.
[c] FY 2008 Enacted Appropriations reflect a reduction of $1,301,000 due to the FY 2008 Government-wide Rescission of 0.91 percent.

The following table provides a breakdown of planned spending by design, procurement, construction, and commissioning for the next few fiscal years (in thousand of dollars):

Phase	FY 2009	FY 2010	FY 2011
Design	17,149	10,748	10,122
Procurement	10,372	4,431	14,752
Construction	24,833	25,550	21,757
Commissioning	3,178	1,602	4,568
Total	55,531	42,331	51,199

6. Details of Project Cost Estimate

	(dollars in thousands)		
	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	165,828	171,796	n/a
Equipment/Procurement[a]	149,494	151,508	n/a
Facility Construction[b]	441,970	433,681	610,000
Commissioning[c]	233,979	240,015	n/a
Technical Support/Transition	16,762	21,200	n/a
Contingency/Fee[d]	201,967	191,800	n/a
Total, Construction	1,210,000	1,210,000	610,000
Total, TEC	1,210,000	1,210,000	610,000
Contingency, TEC	[201,967]	[191,800]	n/a
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	1,210,000	1,210,000	610,000
Total, Contingency	[201,967]	[191,800]	n/a

Notes:

[a] Equipment/Procurement dollars represent of costs of plant equipment, plant material, and Acquisition Services.

[b] Facility Construction dollars represent construction costs through system turnover.

[c] Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.

[d] Contingency/Fee represents the contractor's Management Reserve, Fee, and DOE Project Contingency.

[e] The value listed in the "Original Validated Baseline - Facility Construction" is a total number for all the values that would normally appear in this column. A breakout for the March 2003 Baseline is not available, as until FY 2006 the facilities were not separated but totaled for the whole project, and the current breakout methodology was implemented in FY 2008.

7. Funding Profile History

		($K)								
Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2008 Performance Baseline	TEC	597,845	40,000	20,000	39,000	50,000	45,000	35,000	310,155	1,137,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	597,845	40,000	20,000	39,000	50,000	45,000	35,000	310,155	1,137,000
FY 2009	TEC	597,845	110,000	65,000	60,000	50,000	45,000	35,000	174,155	1,137,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	597,845	110,000	65,000	60,000	50,000	45,000	35,000	174,155	1,137,000
FY 2010	TEC	597,845	50,000	5,000	50,000	75,000	105,000	90,000	237,155	1,210,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	597,845	50,000	5,000	50,000	75,000	105,000	90,000	237,155	1,210,000
FY 2011	TEC	597,845	50,000	5,000	55,000	70,000	105,000	82,500	244,655	1,210,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	597,845	50,000	5,000	55,000	70,000	105,000	82,500	244,655	1,210,000

8. Related Operations and Maintenance Funding Requirements

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

9. Required D&D Information

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

10. Acquisition Approach

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant Project level data sheet.

The following facility milestone dates are based on the contractor's December 2008 Internal Replan and revised contract signed in January 2009.

Balance of Facilities Milestones

Milestone Title	Milestones - January 2009
Start Construction (Site Work)	November 15, 2001 A
Complete Construction Water Treatment Building*	July 27, 2010
Complete Chiller Compressor Plant Construction*	March 22, 2012
Design Complete	December 2014
Set two Emergency Diesel Generators and Complete Site Energization*	May 29, 2015
Complete Construction	January 2017
A=Actual date construction started which followed approval of CD-3B * Contract Milestones-January 2009 Contract	

01-D-16D, High-Level Waste Facility, Hanford, WA

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decision for the overall Waste Treatment and Immobilization Plant Project is Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. The latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments included with this Construction Project Data Sheet are based on March 2009 project data.

The current Total Project Cost for the High-Level Waste Facility is $3,240,000,000. Facility milestone dates are consistent with the revised January 2009 contract.

A Federal Project Director with interim certification level III has been assigned to the Waste Treatment and Immobilization Plant Project.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008	4Q FY1995	4Q FY1996	4Q FY2010	3Q FY2003	3Q FY2003	2Q FY2017	N/A	N/A
FY 2009	4Q FY1995	4Q FY1996	2Q FY2013	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2010	4Q FY1995	4Q FY1996	1Q FY2016	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011	4Q FY1995	4Q FY1996	1Q FY2016	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:

1. The FY 2009 Budget Request date for 'PED Complete' is based on the June 2007 Execution Revision schedule.
2. The FY 2008 Budget Request 'CD-3' date of 3Q FY 2002 represented the start of physical construction of the facility. The FY 2009 Budget Request 'CD-3' date represents the CD-3c date approval, which authorized full construction. Note that CD - 3a and CD - 3b were approved prior to allow for pre-construction activities.
3. The FY 2008 Budget Request date for 'CD-4' of 2Q FY 2017 represented the completion of physical construction of the facility. In the FY 2009 Budget Request, the 'CD-4' completion date represents the completion of construction, start-up, commissioning, and the transfer of the WTP Project to the operations contractor.
4. The FY 2010 Budget Request 'PED Complete' date is based on the revised contract signed in January 2009.

The Mission Need (Critical Decision-0) for the Waste Treatment and Immobilization Plant Project was approved in September 1995, followed by Critical Decision - 1 in September 1996, and Critical

Decision - 2 in August 1998. The Waste Treatment and Immobilization Plant Project was initiated as a privatization contract in 1998, and then was re-bid to a conventional cost reimbursable type contract in December 2000. In May 2002, Critical Decision - 3b - Preliminary Construction - was approved, which authorized basemat concrete and concrete walls to grade, and allowed the first concrete placement for the High-Level Waste Facility in July 2002. In April 2003, a revised Performance Measurement Baseline (Critical Decision - 2) and Full Construction Authorization (Critical Decision - 3c) were formally approved for the Waste Treatment and Immobilization Plant Project.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	0	1,512,664	1,512,664	0	0	0	1,512,664
FY 2008	0	3,308,000	3,308,000	0	0	0	3,308,000
FY 2009	0	3,308,000	3,308,000	0	0	0	3,308,000
FY 2010	0	3,240,000	3,240,000	0	0	0	3,240,000
FY 2011	0	3,240,000	3,240,000	0	0	0	3,240,000

Note: FY 2007 budget submittal values above did not include the estimated facility costs prior to FY 2006. These prior year costs (FY 2001 - FY 2005, included in Line Item 01-D-416) were added to the FY 2008 budget submittal values to provide the total estimated cost for the facility.

A revised Performance Measurement Baseline for the overall Waste Treatment Plant project was validated and approved on December 22, 2006, with a Total Project Cost of $12,263,000,000. The estimated High-Level Waste Facility portion of the current Total Project Cost is $3,240,000,000.

4. Project Description, Justification, and Scope

The High-Level Waste Facility will process the most radioactive and dangerous tank waste at Hanford. The six-story facility covers an area 275 feet wide by 440 feet long and 95 feet tall, with a total building volume of 8.6 million cubic feet. Overall construction will include 11,600 tons of structural steel, 88,000 cubic yards of concrete, 576 tons of heating and ventilation ductwork, 30 miles of piping, and 293 miles of electrical cable.

The High-Level Waste Facility will receive the high-level waste fraction from the Pretreatment Facility. This facility contains two melters for vitrifying the high-level waste fraction into glass. The two melters have a combined design capacity (name plate) and combined treatment capacity (at 70 percent of plant availability) of 6.0 metric tons and 4.2 metric tons of glass per day, respectively. The vitrified waste is poured into stainless steel canisters that are 2 feet in diameter by 14.5 feet tall, and weigh more than 4 tons each. The canisters will be temporarily stored at the Hanford Site before eventually being shipped to a federal geological repository for disposal.

FY 2009 Accomplishments:

Design Activities:

- Released the remaining concrete embed drawings for fabrication to support construction of the second to third floor walls of the facility.
- Issued the High Level Waste Form Compliance Plan and Waste Form Qualification Report.

- Completed final design of the High Level Waste Melter Assembly to incorporate changes resulting from the more conservative Revised Ground Motion (seismic) criteria.
- Completed Research and Technology simulant testing on the redesigned auto-sampler system.

Procurement Activities:

- Accelerated fabrication/delivery of concrete embedments to support near-term construction needs and increase backlog materials to support construction for the next 6-months
- Accepted delivery of key materials and equipment, including the High Level Waste Offgas system High-Efficiency Mist Eliminators and second to third floor concrete embedments and pipe connection assemblies
- Completed fabrication, testing, delivery and receipt of Melter Cave #1 and #2 shield doors
- Awarded the contract for the vertical shield door recovery assembly and the Thermal Catalytic Oxidizer, a major component of the High Level Waste process Offgas System.

Construction Activities:

- Completed forming, rebar, and placement of concrete for 30 walls and 16 slabs on the first to second floor for a total of 5,480 cubic yards of concrete placed
- Continued civil build out; and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities
- Installed major plant structural components including:
  - Canister transfer cart maintenance crane steel/rails
  - Melter #2 pour tunnel canister transfer cart maintenance room crane and shield door
  - Filter cave crane maintenance shield door frame assembly.

Planned FY 2010 Activities:

Design Activities:

- Complete Heating, Ventilation and Air Conditioning Title II design
- Complete Autosampler system design
- Issue civil engineering drawings for slabs at the fourth floor elevation
- Freeze the electrical single-line design.

Procurement Activities:

- Complete fabrication and delivery of the first High Level Waste Melter Assembly
- Complete fabrication, testing, delivery and acceptance of Melter cave #1 crane maintenance shield door
- Receive and accept two Melter feed vessel agitators
- Increase backlog of materials supporting construction to greater than 6-months to increase construction efficiency.

Construction Activities:

- Complete forming, rebar, and placement of concrete for 25 walls and 11 slabs on the first to third floors for a total of 4,720 cubic yards of concrete placed
- Complete erection of structural steel between the first and second floors
- Complete setting of six shield doors for Melter caves #1 and #2
- Continue civil build out; and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities at the basement, first and second floors in accordance with the master schedule

- Complete prerequisite civil/structural construction to release the installation of pipe hangers at the first floor elevation.

Planned FY 2011 Activities:

Design Activities:

- Complete Title II Civil Engineering Design
- Complete Architectural Design.

Procurement Activities:

- Maintain backlog of materials supporting construction to greater than 6-months to increase construction efficiency
- Receive the High Efficiency Particulate Air filter housings and dampers for the primary ventilation system
- Receive a Plant Wash Vessel
- Receive High Level Waste Melter Offgas Treatment Process System fans.

Construction Activities:

- Complete forming, rebar, and placement of concrete for 50 walls and slabs on the second to third floors for a total of 7,000 cubic yards of concrete placed
- Continue civil build out; and installation of piping, hangers, heating, ventilation, and air-conditioning duct, and other commodities
- Install High Efficiency Particulate Air filter housings in the Filter Cave
- Complete installation of the stainless steel liners in Pour Tunnels #1 and #2.

The following table provides the status for each phase by the end of each fiscal year: accomplished for FY 2009, planned for FY 2010, and proposed for FY 2011.

Phase	FY 2009	FY 2010	FY 2011
Design	81%	87%	91%
Procurement	53%	67%	85%
Construction	26%	33%	43%
Commissioning	2%	3%	4%
Overall[a]	49%	57%	65%

[a] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2005[a]	821,536	821,536	704,700
FY 2006	102,964	102,964	121,991
FY 2007[b]	177,000	154,300	115,124
FY 2008[c]	175,389	198,089	176,302
FY 2009	125,000	125,000	202,998
FY 2010	160,000	160,000	239,707
FY 2011	260,178	260,178	197,090
FY 2012	230,000	230,000	214,420
FY 2013	155,000	155,000	172,211
FY 2014	135,000	135,000	142,932
FY 2015	160,000	160,000	165,076
FY 2016	190,000	190,000	181,464
FY 2017	215,000	215,000	203,967
FY 2018	165,000	165,000	208,137
FY 2019	167,933	167,933	144,584
FY 2020	-	-	49,297
Total, Construction	3,240,000	3,240,000	3,240,000

[a] The prior year appropriations and obligation have been updated to reflect a more current estimate of the anticipated utilization of the non-facility specific carryover funding remaining in the WTP line item 01-D-416. The FY 2005 line is based on facility costs prior the split of the WTP into the five facilities.

[b] 10 percent of the FY 2007 Appropriation has been held back as a result of not achieving Secretarial certification of the contractor's Earned Value Management System by September 30, 2007 The certification was received in FY 2008, at which time the $69,000,000 was obligated to the project. High-Level Waste's portion of the hold-back is $22,700,000

[c] FY 2008 Enacted Appropriations reflect a reduction of $1,611,000 due to the FY 2008 Government-wide Rescission of 0 91 percent.

The following table provides a breakdown of current and planned spending by design, procurement, construction, and commissioning for the next few fiscal years (in thousand of dollars):

Phase	FY 2009	FY 2010	FY 2011
Design	62,447	42,873	30,963
Procurement	51,572	104,809	64,806
Construction	85,047	85,226	92,409
Commissioning	3,932	6,800	8,912
Total	202,998	239,708	197,090

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	676,441	671,562	n/a
Equipment/Procurement[a]	650,335	686,037	n/a
Facility Construction[b]	949,174	937,015	1,650,000
Commissioning[c]	272,272	248,386	n/a
Technical Support/Transition	50,731	53,000	n/a
Contingency/Fee[d]	641,047	644,000	n/a
Total, Construction	3,240,000	3,240,000	1,650,000
Total, TEC	3,240,000	3,240,000	1,650,000
Contingency, TEC	[641,047]	[644,000]	n/a
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	3,240,000	3,240,000	1,650,000
Total, Contingency	[641,047]	[644,000]	n/a

Notes:

[a] Equipment/Procurement dollars represent of costs of plant equipment, plant material, and Acquisition Services.

[b] Facility Construction dollars represent construction costs through system turnover.

[c] Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.

[d] Contingency/Fee represents the contractor's Management Reserve, Fee, and DOE Project Contingency.

[e] The value listed in the "Original Validated Baseline - Facility Construction" is a total number for all the values that would normally appear in this column. A breakout for the March 2003 Baseline is not available, as until FY 2006 the facilities were not separated but totaled for the whole project, and the current breakout methodology was implemented in FY 2008.

7. Funding Profile History

Request		($K)								
		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2008	TEC	1,401,889	175,000	180,000	182,000	210,000	255,000	280,000	624,111	3,308,000
Performance	OPC	0	0	0	0	0	0	0	0	0
Baseline	TPC	1,401,889	175,000	180,000	182,000	210,000	255,000	280,000	624,111	3,308,000
FY 2009	TEC	1,401,889	120,000	140,000	180,000	210,000	260,500	280,000	715,611	3,308,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,401,889	120,000	140,000	180,000	210,000	260,500	280,000	715,611	3,308,000
FY 2010	TEC	1,401,889	160,000	240,000	220,000	170,000	140,000	170,000	738,111	3,240,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,401,889	160,000	240,000	220,000	170,000	140,000	170,000	738,111	3,240,000
FY 2011	TEC	1,401,889	160,000	260,178	230,000	155,000	135,000	160,000	737,933	3,240,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	1,401,889	160,000	260,178	230,000	155,000	135,000	160,000	737,933	3,240,000

8. Related Operations and Maintenance Funding Requirements

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

9. Required D&D Information

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

10. Acquisition Approach

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet. The following facility milestone dates are based on the December 2008 Internal Re-plan and revised contract signed in January 2009.

High-Level Waste Facility Milestones

Milestone Title	Milestones - January 2009
Construction	July 10, 2002 A
Complete Design	November 30, 2015
Complete Construction	September 30, 2016
Start Cold Commissioning*	June 30, 2018
Complete Hot Commissioning*	July 30, 2019
A=Actual date construction started which followed approval of CD-3B * Contract Milestones-January 2009 Contract	

01-D-16E, Pretreatment Facility, Hanford, WA

1. Significant Changes

The most recent DOE Order 413.3A approved Critical Decision for the overall Waste Treatment and Immobilization Plant Project is Critical Decision-2 and Critical Decision-3c, approved on 4/21/2003, with a Total Project Cost of $5,781,000,000 and Critical Decision-4 of July 2011. The latest approved Baseline Change was on December 22, 2006 with a Total Project Cost of $12,263,000,000 and Critical Decision-4 of November 2019.

This Construction Project Data Sheet is an update of the FY 2010 Construction Project Data Sheet. The estimated cost, schedule dates, and accomplishments included with this Construction Project Data Sheet are based on March 2009 project data.

The current Total Project Cost for the Pretreatment Facility is $4,939,000,000. Facility milestone dates are consistent with the revised January 2009 contract.

A Federal Sub-Project Director with a current level III certification has been assigned to the Pretreatment Facility, per the DOE Project Management Career Development Program.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2007	4Q FY1995	4Q FY1996	4Q FY2007	3Q FY2003	3Q FY2003	3Q FY2008	N/A	N/A
FY 2008	4Q FY1995	4Q FY1996	3Q FY2013	3Q FY2003	3Q FY2003	2Q FY2017	N/A	N/A
FY 2009	4Q FY1995	4Q FY1996	1Q FY2013	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2010	4Q FY1995	4Q FY1996	4Q FY2015	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A
FY 2011	4Q FY1995	4Q FY1996	4Q FY2015	3Q FY2003	3Q FY2003	1Q FY2020	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

Notes:

1) The FY 2009 Budget Request date for 'PED Complete' was based on the June 2007 Execution Revision schedule.
2) The FY 2008 Budget Request 'CD-3' date of 3Q FY 2002 represented the start of physical construction of the facility. The FY 2009 Budget Request 'CD-3' date represents the CD - 3c date approval, which authorized full construction. Note that CD - 3a and CD - 3b were approved prior to allow for pre-construction activities.
3) The FY 2008 Budget Request date for 'CD-4' of 2Q FY 2017 represented the completion of physical construction of the facility. In the FY 2009 Budget Request the 'CD-4' completion date of 1Q FY 2020 represents the completion of construction, start-up, commissioning and the transfer of the facility to the operations contractor.

The Mission Need (Critical Decision - 0) for the Waste Treatment and Immobilization Plant Project was approved in September 1995, followed by Critical Decision - 1 in September 2006, and Critical Decision - 2 in August 1998. The Waste Treatment and Immobilization Plant Project was initiated as a privatization contract in 1998, and then was re-bid to a conventional cost reimbursable type contract in December 2000. In May 2002, Critical Decision - 3b - Preliminary Construction - was approved, which authorized basemat concrete and concrete walls to grade, and allowed the first concrete placement for the Pretreatment Facility in November 2002. In April 2003, a revised Performance Baseline (Critical Decision - 2) and Full Construction Authorization (Critical Decision - 3c) were formally approved for the Waste Treatment and Immobilization Plant Project.

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2007	0	2,343,745	2,343,745	0	0	0	2,343,745
FY 2008	0	5,394,000	5,394,000	0	0	0	5,394,000
FY 2009	0	5,394,000	5,394,000	0	0	0	5,394,000
FY 2010	0	4,939,000	4,939,000	0	0	0	4,939,000
FY 2011	0	4,939,000	4,939,000	0	0	0	4,939,000

Note: FY 2007 budget submittal values above did not include the facility costs prior to FY 2006. These prior year costs (FY 2001 - FY 2005, included in line item 01-D-416) were added to the FY 2008 budget submittal values to provide the total estimated cost for the facility.

A revised Performance Baseline for the overall Waste Treatment Plant project was validated and approved on December 22, 2006, with a Total Project Cost of $12,263,000,000. The estimated Pretreatment Facility portion of the Total Project Cost is $4,939,000,000.

4. Project Description, Justification, and Scope

The largest of all Waste Treatment and Immobilization Plant facilities, the Pretreatment Facility, is a twelve-story building with 490,000 square feet of floor space and a foot print of approximately two football fields. It is constructed of 112,000 cubic yards of concrete and 16,400 tons of structural steel, and contains 527,000 feet (100 miles) of piping.

The Pretreatment Facility will separate radioactive tank waste into high-activity waste and low-activity waste fractions and transfer the segregated waste to the High-Level Waste Facility and the Low-Activity Waste Facility for vitrification. The facility has the design capacity (name plate) and treatment capacity (at 70 percent plant availability) to process 3,740 metric tons and 2,260 metric tons, respectively, of low-activity waste sodium per year, and a design capacity (name plate) and treatment capacity (at 70 percent plant availability) to process 1,225 metric tons and 860 metric tons, respectively, of high-activity as-delivered solids per year. The main pretreatment processes include filtration to separate the high curie solids from the low-activity liquids, evaporation to remove excess water, and an ion exchange system to remove cesium from the tank waste. The processing of the waste will be accomplished in black cells (isolated from entry) and a hot cell (remotely accessible) which are located in concrete structures in the center of the building. A hardened control room building and an annex building will be located adjacent to the Pretreatment Facility.

FY 2009 Accomplishments:

Design Activities:

- Released design of remaining 13 of 50 reinforced concrete walls between the 56-foot and 77-foot elevations (third to fourth floors). This release provided an additional 1,250 cubic yards of concrete for construction to place.
- Released roof framing drawings at elevation 116 ft (roof), for the fabrication of the main building roof structure. This release took the total steel released to date to 13,500 tons out of 16,500 tons, and completed the release of the main Pretreatment building structure
- Issued all pipe isometric drawings for the Low-Activity Waste feed receipt area. This enabled construction to install the pipe in the black cells for four Low-Activity Waste feed receipt storage vessels.
- Issued closure package and closure record for the External Flowsheet Review Team issue M12, validation of caustic leaching and ultra-filtration performance.

Construction Activities:

- Installed the 12-foot square by 9-inch thick 20 ton waste handling area spent filter radiological shield door into its final position. Installation of the door allowed the structure above the door to be completed.
- Completed erection of the building main frame steel work at the west end of the building from elevation 56-foot to 77-foot (third to fourth floors). This completed the steelwork erection for the first eight column lines at this elevation.

Planned FY 2010 Activities:

Design Activities:

- Release design of the final 13 of 47 12-inch thick reinforced concrete floor slabs at the 77-foot elevation (fourth floor) for construction. This release provides an additional 1,100 cubic yards of concrete for construction to place.
- Release design for the final 9 of 36 reinforced concrete walls between the 77-foot and 98-foot elevation (fourth to fifth floor walls). This release provides an additional 650 cubic yards of concrete for construction to place.
- Finalize and issue closure package and closure record for the External Flowsheet Review Team issue M3, vessel mixing testing program.
- Complete design of all piping racks in the Pretreatment facility.
- Complete the installation of all walls from the 56 foot to the 77 foot elevations except for two construction openings.

Procurement Activities:

- Deliver the three demister units for the Pretreatment filter cave to the material handling facility. Successful completion of the Material Receiving Report to enable construction forces to withdraw the exchanger for installation in the Pretreatment filter cave.

Construction Activities:

- Install two hot cell shield doors (80 ton and 104 ton).
- Complete all structural steel installations from the 56 foot to the 77 foot elevations.

Planned FY 2011 Activities:

Procurement Activities:

- Deliver for installation the Cesium Ion Exchange spiral plate heat exchangers (feed coolers).
- Receive the Cesium Nitric Acid Recovery re boiler and heat exchanger. This allows it's installation in the hot cell planning area 21.

Construction Activities:

- Complete the vessel upgrades for three spent resin collection and dewatering vessels to incorporate the revised seismic assessment criteria. The upgrades could include stiffening the pipe work nozzle connections and additional supports to the vessel internals.
- Lift into position the lower pipe module for the Low-Activity Waste feed receipt cell. The module contains approx 13,000 feet of stainless steel pipe, is 37-feet by 54-feet, and weighs 70 tons. The module will be located above the 48-foot diameter Low-Activity Waste feed receipt vessel.
- Set support frame structures for process jumpers and process equipment in the hot cell.
- Place the 112-ton, 14-foot diameter by 30-foot tall Ultrafiltration feed preparation vessel in the black cell located on the South side of the facility.

The following table provides the status for each phase by the end of each fiscal year: accomplished for FY 2009, planned for FY 2010, and proposed for FY 2011.

Phase	FY 2009	FY 2010	FY 2011
Design	76%	83%	91%
Procurement	39%	52%	72%
Construction	30%	37%	44%
Commissioning	2%	2%	3%
Overall [a]	46%	54%	63%

[a] The WTP project Design/Engineering total percent complete calculations factor in Research and Testing, Process Engineering, and Environmental & Nuclear Safety costs which are in addition to the five facilities costs.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2005[a]	1,174,323	1,170,267	1,136,272
FY 2006[b]	147,515	151,571	154,288
FY 2007	211,000	170,400	130,570
FY 2008[c]	250,698	291,298	239,496
FY 2009	265,000	265,000	303,805
FY 2010	325,000	325,000	362,286
FY 2011	415,000	415,000	402,439
FY 2012	315,000	315,000	312,500
FY 2013	380,000	380,000	392,397
FY 2014	360,000	360,000	361,159

	(dollars in thousands) Appropriations	Obligations	Costs
FY 2015	335,000	335,000	336,815
FY 2016	235,000	235,000	228,071
FY 2017	225,000	225,000	216,217
FY 2018	255,000	255,000	260,499
FY 2019	45,464	45,464	101,559
FY 2020	-	-	627
Total, Construction	4,939,000	4,939,000	4,939,000

[a] The FY 2005 line is based on facility costs prior the split of the WTP into the five facilities.
[b] The WTP Project received an extra obligation of $4,056,000 in FY 2006 to recover a holdback in FY 2005.
[c] 10 percent of the FY 2007 Appropriation has been held back as a result of not achieving Secretarial certification of the contractor's Earned Value Management System by September 30, 2007. The certification was received in FY 2008, at which time the $69,000,000 was obligated to the project. Pretreatment's portion of the hold-back is $40,600,000.

The following table provides a breakdown of current and planned spending by design, procurement, construction, and commissioning for the next few fiscal years (in thousands of dollars):

Phase	FY 2009	FY 2010	FY 2011
Design	129,420	86,890	76,764
Procurement	85,223	155,367	195,015
Construction	82,402	109,124	114,199
Commissioning	6,761	10,905	16,461
Total	303,805	362,286	402,439

6. Details of Project Cost Estimate

	(dollars in thousands) Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total Estimated Cost (TEC)			
Design (PED)			
Total, PED	N/A	N/A	N/A
Construction			
Site Preparation	n/a	n/a	n/a
Engineering/Design	1,104,011	1,070,440	n/a
Equipment/Procurement[a]	1,049,151	1,066,188	n/a
Facility Construction[b]	1,563,618	1,537,407	1,920,000
Commissioning[c]	405,464	365,965	n/a
Technical Support/Transition	70,210	58,500	n/a
Contingency/Fee[d]	746,546	840,500	n/a
Total, Construction	4,939,000	4,939,000	1,920,000
Total, TEC	4,939,000	4,939,000	1,920,000
Contingency, TEC	[746,546]	[840,500]	n/a
Other Project Cost (OPC)	N/A	N/A	N/A
Contingency, OPC			
Total, TPC	4,939,000	4,939,000	1,920,000

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[e]
Total, Contingency	[746,546]	[840,500]	n/a

Notes:

[a] Equipment/Procurement dollars represent of costs of plant equipment, plant material, and Acquisition Services.

[b] Facility Construction dollars represent construction costs through system turnover.

[c] Commissioning dollars represent the cost of Start-up, Cold Commissioning, and Hot Commissioning.

[d] Contingency/Fee represents the contractor's Management Reserve, Fee, and DOE Project Contingency.

[e] The value listed in the "Original Validated Baseline - Facility Construction" is a total number for all the values that would normally appear in this column. A breakout for the March 2003 Baseline is not available, as until FY 2006 the facilities were not separated but totaled for the whole project, and the current breakout methodology was implemented in FY 2008.

7. Funding Profile History

		($K)								
Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Outyears	Total
FY 2008 Performance Baseline	TEC	2,048,536	345,000	340,000	320,000	365,000	340,000	325,000	1,310,464	5,394,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	2,048,536	345,000	340,000	320,000	365,000	340,000	325,000	1,310,464	5,394,000
FY 2009	TEC	2,048,536	300,000	400,000	320,000	365,000	334,500	325,000	1,300,964	5,394,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	2,048,536	300,000	400,000	320,000	365,000	334,500	325,000	1,300,964	5,394,000
FY 2010	TEC	2,048,536	325,000	380,000	335,000	355,000	360,000	315,000	820,464	4,939,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	2,048,536	325,000	380,000	335,000	355,000	360,000	315,000	820,464	4,939,000
FY 2011	TEC	2,048,536	325,000	415,000	315,000	380,000	360,000	335,000	760,464	4,939,000
	OPC	0	0	0	0	0	0	0	0	0
	TPC	2,048,536	325,000	415,000	315,000	380,000	360,000	335,000	760,464	4,939,000

8. Related Operations and Maintenance Funding Requirements

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

9. Required D&D Information

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

10. Acquisition Approach

See the discussion in the 01-D-416, Waste Treatment and Immobilization Plant project level data sheet.

The following facility milestone dates are based on the contractor's December 2008 Internal Replan and revised contract signed in January 2009.

Pretreatment Facility Milestones

Milestone Title	Milestones - January 2009
Start Construction	November 21, 2002 A
Complete Design	July 2015
Complete Construction	March 2016
Start Cold Commissioning*	September 30, 2017
Complete Hot Commissioning*	February 28, 2019
A=Actual date construction started which followed approval of CD-3B * Contract Milestones-Jan. 09 Contract	

Savannah River

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Savannah River National Laboratory	58,500	0	61,480	61,000
Savannah River Operations Office	19,800	0	18,300	18,330
Savannah River Site	1,144,443	1,615,400	1,130,169	1,138,469
Total, Savannah River	1,222,743	1,615,400	1,209,949	1,217,799

Site Overview

The Savannah River Site is a Department of Energy (DOE) industrial complex dedicated to the reduction of risks through safe stabilization, treatment, and disposition of legacy nuclear materials, spent nuclear fuel, waste and waste units, and facilities. Activities include a National Nuclear Security Administration program that supports the DOE national security and non-proliferation programs, and support activities at the Savannah River National Laboratory.

American Recovery and Reinvestment Act Activities

The Savannah River Site American Recovery and Reinvestment Act (ARRA) activities are funded at $1,615,400,000. Specifically, this funding will accelerate the shipment of more than 4,500 cubic meters of transuranic waste out of South Carolina for permanent disposal at the Waste Isolation Pilot Plant, accelerate in-situ decommissioning of two nuclear materials production reactors (P and R Reactors), and cleanup of contaminated areas throughout the site (e.g., A Area, D Area, E Area, M Area), reducing the site's industrial area by 40 percent, or 79,000 acres, by September 2011. ARRA work also includes the refurbishment of existing tank waste infrastructure and systems involving numerous long-lead equipment procurements. The American Recovery and Reinvestment Act funding will accelerate transuranic waste disposal by four years from 2016, and the decommissioning of the nuclear facilities by at least five years.

Site Description

The Savannah River Site is 310 square miles in size with 1,000 facilities concentrated within only 10 percent of the total land area. As cleanup activities are completed, it is anticipated that future nuclear operations will typically be located within the site's central interior. The land surrounding such locations provides a protective buffer for such activities. Other locations on site (i.e. less distant and near to the site perimeter to promote fuel conservation and enhance transportation access/egress) may be considered for other types of missions/operations. Selected excess EM facilities and inactive waste units are being deactivated, decommissioned, and remediated, as warranted. Facility decommissioning alternatives include demolition and in-situ disposal.

Site Cleanup Strategy/Scope of Cleanup

The EM completion strategy provides a comprehensive risk-based approach to the EM cleanup project by disposition of radioactive liquid waste through vitrification of the high activity component at the Defense Waste Processing Facility and disposal of the low-activity component through Saltstone; use of existing Savannah River Site facilities to receive, store, and disposition aluminum-clad spent nuclear fuel; disposition excess plutonium using Savannah River Site facilities; disposition legacy transuranic waste to the Waste Isolation Pilot Plant; decommissioning of all EM facilities that are not required for continuing missions; remediation of waste units, as warranted; and use existing Savannah River Site waste treatment, storage, and disposal capabilities to efficiently and safely complete the EM cleanup project and support other Savannah River Site tenants. The scope of cleanup completed at the Savannah River Site includes 368 inactive waste units that have been completed out of a total of 515 waste units; and 248 excess facilities that have been decommissioned out of a total of 973 excess facilities.

The Savannah River Site cleanup strategy has three primary objectives: (1) eliminate or minimize nuclear materials, spent nuclear fuel, and waste through safe stabilization, treatment, and/or disposition; (2) reduce the costs of continuing operations and surveillance and maintenance; and (3) decommission all EM-owned facilities, except those identified for transfer to another Program Secretarial Office, and remediate groundwater and contaminated soils consistent with the Area Completion Strategy, and the Groundwater Management Strategy and Implementation Plan.

Site Completion (End-State)

The EM lifecycle planning estimate range is 2038 to 2040. Inactive waste units will be remediated by employing an area-by-area completion strategy and any contaminated groundwater will be remediated, undergoing remediation, or monitored to ensure protection of human health and the environment. Units at which residual materials are left in place will be under institutional controls, comprised of access restrictions, inspections, maintenance, and monitoring. Concurrently with the area completions, all EM facilities will be decommissioned.

Regulatory Framework

The DOE-Savannah River Operations Office and its contractors will continue to work proactively with the South Carolina Department of Health and Environmental Control, the Environmental Protection Agency-Region 4, the Nuclear Regulatory Commission, the Defense Nuclear Facilities Safety Board, oversight groups, and stakeholders to facilitate the accomplishment of the environmental cleanup and risk reduction objectives at Savannah River Site. There are several key agreements that facilitate the cleanup of the Site. Subsequent to State-initiated enforcement actions, several key settlement agreements have been entered into with the State of South Carolina.

The *Federal Facility Agreement* for the Savannah River Site ensures that environmental releases, and potential releases of contaminates are investigated and appropriate action is taken to protect human health and the environment. This agreement is legally enforceable (with fines and penalties possible for noncompliance) and is required under Federal Regulation because the Savannah River Site is listed on the Environmental Protection Agency National Priorities List.

The Savannah River Site Area Completion Strategy addresses all of the known or potential contaminant releases to the environment from operable units, site evaluation areas, and remnants of decommissioned facilities. The Strategy is to combine the investigations, assessments, and cleanup actions for several waste units which saves time, reduces documentation, lowers costs, and facilitates the EM completion of entire industrial areas, each contributing to Site footprint reduction.

Public Law 107-107, Section 3155, Disposition of Surplus Defense Plutonium at the Savannah River Site, Aiken, South Carolina requires a disposition pathway out of the State of South Carolina for all Plutonium transferred to the Savannah River Site.

National Defense Authorization Act for Fiscal Year 2001 (Public Law 106-398) as modified by subsection (b) of Section 3115, Continuation of Processing; Treatment, and Disposition of Legacy Nuclear Materials, of the National Defense Authorization Act for Fiscal Year 2004 (Public Law 108-136) requires H-Canyon/HB-Line to continue operations and be in a high state of readiness and shall provide technical staff necessary to operate and maintain such a facility.

The Savannah River Site Treatment Plan requires radioactive mixed waste to be treated to hazardous waste standards within an agreed-upon schedule. Radioactive liquid waste is an example of radioactive mixed waste. The Site Treatment Plan is enforceable by a consent order signed by the Department of Health and Environmental Control and Savannah River.

Saltstone Disposal Facility Industrial Solid Waste Landfill Permit contains milestone commitments related to salt waste treatment and disposition. Saltstone Disposal Facility is operated as a Class 3 Industrial Solid Waste Landfill (Permit #025500-1603). The State of South Carolina permitted Saltstone Disposal Facility under its authority pursuant to Subpart D of the Resource Conservation and Recovery Act and Chapter 61, Article 107 (Solid Waste Management) of the South Carolina Health and Environmental Control Regulations, Subpart 16, Industrial Solid Waste Landfills.

Section 3116 of the Ronald W. Reagan National Defense Authorization Act allows the Secretary of Energy, in consultation with the Nuclear Regulatory Commission, to determine when waste from reprocessing of spent nuclear fuel is appropriate for onsite disposition as other than high-level waste when certain criteria are met. In addition to the Nuclear Regulatory Commission consultation, the Savannah River Site must obtain South Carolina Department of Health and Environmental Control approval on closure documentation required by the Industrial Waste Water Permit issued by the South Carolina Department of Health and Environmental Control prior to initiating tank closure activities.

Nuclear Cooperation Agreements govern the shipment and receipt of Foreign Research Reactor Spent Nuclear Fuel. Savannah River Site has received and expects to receive additional Foreign Research Reactor Spent Nuclear Fuel through FY 2019 that has restrictions regarding the use and/or recycling of the fuel.

Critical Project Uncertainties and Assumptions

Program-specific uncertainties that could have significant impacts on individual projects and may impact the overall cleanup scope, schedule, and costs have been identified:

- Delays in off-site disposal would require increased storage capacity for high-level waste and spent nuclear fuel;

- Controlling sources of soil/groundwater contamination through sustained area-by-area completion is critical to aquifer/stream protection and risk reduction, and will support passive and natural groundwater remedies that are critical to reducing the cost of long term stewardship;
- Uncertainties within the radioactive liquid waste disposition program (i.e., the waste determination process under section 3116 of the FY 2005 National Defense Authorization Act) could delay tank closures;
- Uncertainties associated with the disposition path for the Savannah River Site heavy water could delay final closure of L-Area and increase disposition costs;
- Nuclear nonproliferation concerns are leading to continual increases in the amount, type, and schedule of Foreign Research Reactor fuel returns;
- Fuel Receipts are expected near term to be 80 percent Foreign Research Reactor Fuel; 20 percent Domestic Research Reactor Fuel;
- Uncertainties in the disposition strategy for excess plutonium stored at sites by EM;
- Uncertainty in sludge inventory and characteristics of tank waste that could adversely affect disposition costs and schedules;
- Resource Conservation and Recovery Act Permit commitments and Federal Facility Agreement milestones will be met contingent upon successful negotiation with the Environmental Protection Agency Region 4 and South Carolina Department of Health and Environmental Control. Negotiations will be required to reflect delaying Area Completions, re-sequencing associated Integrator Operable Unit activities, and delaying groundwater activities;
- A delay in the start of Salt Waste Processing Facility beyond FY 2013 could delay site completion and compliance with regulatory commitment dates for facility start-up and tank closures;
- DOE will continue to consolidate nuclear materials at the Savannah River Site;
- H-Area nuclear material processing facilities are scheduled to operate through September 30, 2019, to process the currently planned nuclear materials; however, restricting current plutonium loading limits (897g/m^3), would either cause the Canyon to operate beyond September 30, 2019, or alternative disposal paths in glass high-level waste canisters would have to be identified;
- Preparations for shipment of Spent Fuel from L-Area to H-Canyon for disposition must be complete in early FY 2011 in order to begin disposition of Spent Fuel in mid FY 2011;
- Infrastructure upgrades will be needed to maintain reliable H–Canyon/HB-Line operations to 2019;
- Future use of the Savannah River Site remains non-residential; and
- DOE will successfully re-negotiate the Salt Waste Processing Facility operational start date specified under the Saltstone Disposal Facility Landfill permit to be consistent with the approved Critical Decision-3.

Interdependencies

Execution of the EM cleanup project at Savannah River Site involves numerous interfaces with other organizations, both-on and off-site. Since EM is the major Savannah River Site program, it provides landlord services to other organizations, primarily the National Nuclear Security Administration.

National Nuclear Security Administration – Nuclear Nonproliferation – Plutonium Disposition – Nuclear Fuel Supply

Savannah River Site has been selected as the location for the construction and operation of facilities to dispose of approximately 34 metric tons of surplus weapons-usable plutonium. Currently, the Department is studying a number of options to transition the Plutonium Preparation Project/Pit Disassembly and Conversion Facility, from two independent construction projects, to one combined project located within the K-Area at the Savannah River site under the National Nuclear Security Administration.

National Nuclear Security Administration – Nuclear Nonproliferation Program – Enriched Uranium Blend-Down

The United States has declared a total of 174.3 metric tons of highly enriched uranium surplus to future weapons needs. Savannah River Site processes and blends highly enriched uranium fuel and other material to low enriched uranium for shipment to the Tennessee Valley Authority vendor for processing and fabrication into commercial reactor fuel assemblies. Approximately 4.7 metric tons of other highly enriched uranium materials were shipped to a Tennessee Valley Authority contractor facility for blend down. The H-Canyon facility (via the Enriched Uranium Disposition Project) will be used to additionally blend down up to 21 metric tons of enriched uranium for transfer to the Tennessee Valley Authority through 2019. Of the 21 metric tons of enriched uranium, an initial amount of 5.6 metric tons has been identified for dissolution through the Canyon by September 30, 2010. Processing, blend down to Low Enriched Uranium and delivery to Tennessee Valley Authority will be complete, for this initial amount, in FY 2011. The material will be added to the Interagency Agreement by a Modification signed by the Tennessee Valley Authority and the Department on April 17, 2009.

Transuranic Waste Disposal

Transuranic waste is being characterized and processed for shipment to the Waste Isolation Pilot Plant. Shipments of transuranic waste drums began in FY 2001. The Waste Isolation Pilot Plant provides both personnel at Savannah River Site who characterize material for shipment, and certain equipment required for transuranic waste processing. Elimination of the transuranic waste inventory at Savannah River Site depends on the continued operation and acceptance of transuranic waste at the Waste Isolation Pilot Plant.

Hazardous and Mixed Waste Disposal

Mixed Low-level waste is a low-level radioactive waste which contains hazardous constituents, and is managed in accordance with DOE Order 435.1, Radioactive Waste Management and hazardous waste regulations. Hazardous mixed-waste generated at the Savannah River Site includes such materials as lead, solvents, paints and pesticides. Therefore the continued operation and cleanup of the Savannah River Site depends on the ability to ship this hazardous waste to offsite vendors. The Nevada Test Site is currently available for disposal of treated mixed waste providing applicable regulatory requirements and waste acceptance criteria are met.

Low-Level Waste Disposal

Some low-level radioactively contaminated material such as small and large pieces of equipment, gloves, soil and material that cannot be proven free of radioactive contamination which are generated at the Savannah River Site are disposed of at other DOE locations (e.g., Nevada Test Site) or at commercial sites. Therefore, the continued cleanup of the Savannah River Site depends on the shipment of these materials to other sites for disposal.

Naval Reactor Waste

Waste, such as reactor components, is routinely received from Naval Reactors. These components are disposed of in E Area.

Nuclear Material Consolidation and Surveillance
The Savannah River Site has one of largest protection Category I facilities in the DOE complex. This unique facility facilitates the consolidation of excess special nuclear material from around the complex in one place at a significant savings to the DOE complex. In addition, the Savannah River Site performs surveillance and monitoring operations on this material to assure continued safe storage.

Tennessee Valley Authority
As previously mentioned, over 23 metric tons of excess highly enriched uranium at Savannah River Site has been dispositioned by both dilution and shipment (over 18 metric tons) to the Tennessee Valley Authority vendors, Areva, and by direct shipment (approximately 4.7 metric tons) to Nuclear Fuel Services. Areva also provides natural uranium for blending. To deinventory H, L, and K Areas, Savannah River Site depends on the Tennessee Valley Authority to provide and accept these materials. Modifications to the Interagency Agreement between the Department of Energy and the Tennessee Valley Authority will continue to be used as the mechanism for establishing the transfer of Low Enriched Uranium to the Tennessee Valley Authority.

Idaho National Laboratory
Shipment of neptunium-237 from the H Canyon was completed in 2009 to the Idaho Laboratory for future plutonium-238 production. Additionally, spent nuclear fuel (containing enriched uranium) will be exchanged between Savannah River Site and Idaho National Laboratory (no earlier than FY 2013). The aluminum-based spent nuclear fuel (at Savannah River Site plus any received from Idaho National Laboratory) will be stored in L-Basin awaiting shipment to H-Canyon for processing and blend-down to low enriched uranium. The non-aluminum based spent nuclear fuel at Savannah River Site is planned to be shipped to the Idaho National Laboratory to be consolidated for packaging with the non-aluminum based spent nuclear fuel already there.

Enriched Uranium Receipts from National Nuclear Security Administration Sites (Y-12 Oak Ridge, Los Alamos, Lawrence Livermore and others)
K-Area will accept enriched uranium materials for lag storage and subsequent shipment to the H-Canyon and HB-Line for processing and blend-down to low enriched uranium in accordance with the Enriched Uranium Disposition Project (as previously discussed).

Contract Synopsis

Savannah River Site operates under two main contracts. One contract is for the management and operation of the Site, and the other supports the tank liquid waste system project. The management and operating contract is with Savannah River Nuclear Solutions, LLC, and the new Liquid Waste System contract was awarded to Savannah River Remediation, LLC, which completed transition July 2009.

In addition, the Salt Waste Processing Facility is a major capital line-item project supporting site cleanup that is not managed by either the managing and operating contractor or the liquid waste contract. The Department of Energy contracted the design, construction and one year of operations under a cost-plus-incentive fee structure with Parsons Infrastructure and Technology.

Cleanup Benefits

Savannah River Site is implementing a cleanup strategy utilizing a project management approach. Currently, 100 percent of the Savannah River Site's nuclear materials that were identified in the Defense

Nuclear Facilities Safety Boards' Recommendation 94-1/2000-1 have been stabilized (54 milestones representing 143,518 items).

Specific program benefits realized from the EM cleanup project are significant. The Area Completion Project is reducing the site's contamination footprint and is reaching consensus with regulators for cleanup decisions and future site use. In addition, the non-compliant radioactive liquid waste tanks are the highest environmental and human health risks in the State of South Carolina according to the South Carolina Department of Health and Environmental Control. Removal of radioactive liquid waste will be completed, and upon completion, the facilities that supported these projects must be deactivated and decommissioned. In addition, the physical locations of the facilities must be closed under the Comprehensive Environmental Response, Compensation, and Liability Act, or other governing permits and laws. The Federal Facility Agreement commitment is to close all non-compliant tanks by FY 2022.

H Canyon and HB Line is the only operational radiological separation facility in the United States. Savannah River Site has consolidated spent nuclear fuel from three storage basins to a single storage basin; all Savannah River Site 94-1/2001 commitments have been met; and all Mk-16/Mk-22 fuel has been dissolved and dispositioned. Additional materials are being dispositioned from across the DOE complex. Legacy transuranic waste is being shipped to the Waste Isolation Pilot Plant nearly three decades ahead of the original schedule.

Direct maintenance and repair at the Savannah River Site is estimated to be $149,782,000.

Funding Schedule by Activity

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2035 Completions, Nuclear Material Stabilization and Disposition, and Tank Farm Activities to newly created control points of Cleanup and Waste Disposition and Site Risk Management Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The funding table below provides a non-comparable display of the PBSs between control points.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Savannah River Site			
2035 Accelerations			
SR-0100 / Savannah River Community and Regulatory Support	6,355	18,300	0
SR-0101 / Savannah River Community and Regulatory Support	13,445	0	0
SR-0040C / Nuclear Facility D&D - 2035	1,552	0	0
SR-0012 / SNF Stabilization and Disposition	30,662	38,768	0
SR-0030 / Soil and Water Remediation	35,513	0	0
SR-0013 / Solid Waste Stabilization and Disposition	42,099	0	0
Subtotal, 2035 Accelerations	129,626	57,068	0
Cleanup and Waste Disposition			
SR-0100 / Savannah River Community and Regulatory Support	0	0	18,330

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Nuclear Material Stabilization and Disposition			
SR-0011C / NM Stabilization and Disposition	361,343	391,625	0
Site Risk Management Operations			
SR-0014C / Radioactive Liquid Tank Waste Stabilization and Disposition-2035	0	0	806,233
SR-0011C / NM Stabilization and Disposition	0	0	370,042
SR-0012 / SNF Stabilization and Disposition	0	0	23,194
Subtotal, Site Risk Management Operations	0	0	1,199,469
Tank Farm Activities			
SR-0014C / Radioactive Liquid Tank Waste Stabilization and Disposition-2035	731,774	761,256	0
Total, Savannah River Site	1,222,743	1,209,949	1,217,799

The funding table below provides a comparable display of the PBSs between control points.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Savannah River Site			
Cleanup and Waste Disposition			
SR-0100 / Savannah River Community and Regulatory Support	6,355	18,300	18,330
SR-0101 / Savannah River Community and Regulatory Support	13,445	0	0
SR-0040C / Nuclear Facility D&D - 2035	1,552	0	0
SR-0030 / Soil and Water Remediation	35,513	0	0
SR-0013 / Solid Waste Stabilization and Disposition	42,099	0	0
Subtotal, Cleanup and Waste Disposition	98,964	18,300	18,330
Site Risk Management Operations			
SR-0014C / Radioactive Liquid Tank Waste Stabilization and Disposition-2035	731,774	761,256	806,233
SR-0011C / NM Stabilization and Disposition	361,343	391,625	370,042
SR-0012 / SNF Stabilization and Disposition	30,662	38,768	23,194
Subtotal, Site Risk Management Operations	1,123,779	1,191,649	1,199,469
Total, Savannah River Site	1,222,743	1,209,949	1,217,799

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Savannah River					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	11,536	11,536	11,536	23,182	49.8%
Enriched Uranium packaged for disposition (Number of Containers)	3,085	3,184	3,184	3,184	100.0%
High-Level Waste packaged for final disposition (Number of Containers)	2,795	2,981	3,278	6,300	52.0%
Industrial Facility Completions (Number of Facilities)	232	232	232	759	30.6%
Liquid Waste in Inventory eliminated (Thousands of Gallons)	2,110	2,810	3,510	33,100	10.6%
Liquid Waste Tanks closed (Number of Tanks)	2	2	4	51	7.8%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	105,064	105,564	105,564	137,579	76.7%
Material Access Areas eliminated (Number of Material Access Areas)	2	2	2	3	66.7%
Nuclear Facility Completions (Number of Facilities)	11	11	11	191	5.8%
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	919	919	919	919	100.0%
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	490	490	490	490	100.0%
Radioactive Facility Completions (Number of Facilities)	8	8	8	40	20.0%
Remediation Complete (Number of Release Sites)	369	369	369	515	71.7%
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	3	3	3	40	7.5%
Transuranic Waste shipped for disposal (Cubic meters) – Contact Handled	6,165	6,165	6,165	15,590	39.5%
Transuranic Waste shipped for disposal (Cubic meters) – Remote Handled	17	17	17	68	25.0%

Detailed Justification

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2035 Completions, Nuclear Material Stabilization and Disposition, and Tank Farm Activities to newly created control points of Cleanup and Waste Disposition and Site Risk Management Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The Detailed Justification Table below has been comparably adjusted to reflect the PBSs within the new control points in order to aid in the review process.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

SR-0013 / Solid Waste Stabilization and Disposition 42,099 0 0

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS scope covers the storage, treatment and disposal functions for transuranic, low- level, mixed low-level, hazardous, and sanitary waste, as well as pollution prevention, waste minimization, waste certification, and other waste management support functions. In addition, this project covers surveillance and maintenance for the Consolidated Incinerator Facility and general “landlord” functions required to maintain Resource Conservation and Recovery Act permit requirements.

In FY 2011, the following activities are planned:

- No planned activities in FY 2011; the scope of work typically covered in this PBS is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	6,165	6,165	6,165	15,590	39.5%
Transuranic Waste shipped for disposal (Cubic meters) - RH	17	17	17	68	25.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	105,064	105,064	105,064	137,579	77.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Begin Resource Conservation and Recovery Act closure for Transuranic Waste Pads 7-13. (FY 2009)
- Remove all Battelle-Columbus remote handled transuranic waste. (FY 2009)
- Complete disposal of legacy drummed transuranic waste at the Waste Isolation Plant (FY 2009)

SR-0030 / Soil and Water Remediation 35,513 0 0

This PBS can be found within the Defense Environmental Cleanup appropriation.

The Soil and Water Remediation PBS scope includes the remediation of Savannah River Site contaminated soils and waste sites to reduce risk and to protect groundwater aquifers and surface waters from the spread of contamination by addressing the sources of contamination using an Area Completion Approach.

In FY 2011, the following activities are planned:

- No planned activities in FY 2011; the scope of work typically covered in this PBS is being executed with ARRA funding.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	369	369	369	515	72.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submit Federal Facility Agreement Appendix E (Outyear Milestones) (FY 2009)
- Issue Record of Decision for M Area Operable Unit (Includes 19 sub-units with 19 associated milestones) (FY 2009)
- Start C Area Burning/Rubble Pit and Old C Area Burning/Rubble Pit Remedial Action (FY 2009)
- Complete Periodic Monitoring and Submit the Steel Creek Integrator Operable Unit Periodic Report # 3 (FY 2009)
- Initiate the Savannah River Floodplain Swamp Integrator Operable Unit Second Phase II Field Start (FY 2009)
- Submit Record of Decision for P Area Operable Unit (Includes 9 sub-units with 9 associated milestones) (FY 2009)
- Start Remedial Action for M Area Operable Unit (Includes 19 sub-units with 19 associated milestones) (FY 2009)

	FY 2009	FY 2010	FY 2011
SR-0040C / Nuclear Facility D&D – 2035	**1,552**	**0**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

An integral part of the cleanup mission for the Office of Environmental Management is the decommissioning of facilities constructed in support of nuclear materials production. At the start of FY 2003, there were 1,013 major facilities to be decommissioned, or to be transitioned to a non-EM organization.

In FY 2011, the following activity is planned:

- No planned activities in FY 2011; the scope of work typically covered in this PBS is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
SR-0101 / Savannah River Community and Regulatory Support	**13,445**	**0**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

This project provides independent environmental monitoring and emergency management activities by the States of South Carolina and Georgia under either an Agreement in Principle or a grant.

In FY 2011, the following activities are planned:

- No activities planned. Scope transferred to PBS SR-0100/Savannah River Community and Regulatory Support.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
SR-0100 / Savannah River Community and Regulatory Support	**6,355**	**18,300**	**18,330**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The purpose and scope of this project is to provide support that enables the Savannah River Site to perform its missions and cleanup objectives. Support activities include archaeological research, geological surveys, ecological research, natural resource management, forestry management, project management, Historically Black Colleges and Universities, and the DOE Summer Diversity Intern Program. Other activities include support and development of a long-term observation network to monitor water level, flow paths, and water quality. This project also provides independent environmental monitoring and emergency management activities by the States of South Carolina and Georgia under either an Agreement in Principle or a grant. The project scope also includes support for the South Carolina Department of Health and Environmental Control, for oversight and implementation of the Federal Facility Agreement. This project scope also includes the operation and maintenance of a public reading room for Savannah River documents to support communication and stakeholder involvement, and Payments-In-Lieu-Of-Taxes for three South Carolina counties (Aiken, Allendale, and Barnwell). Support is provided to the Citizens Advisory Board to include facilitators, technical advisors, meeting rooms, and other expenses.

In FY 2011, the following activities are planned:

- Conduct forest management activities to sustain the Savannah River Sites natural resources.
- Conduct cultural resource management regulatory requirements, through technical reviews of the National Environmental Policy Act and Comprehensive Environmental Response, Compensation, and Liabilities Act documents for National Historic Preservation Act negotiations.
- Provide technical expertise in the conduct of geological surveys and natural resource management.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Execute grant programs with Historically Black Colleges and Universities focusing on scientific research related to environmental issues.

- Continue grant for South Carolina Department of Health Environmental Control oversight of environmental monitoring, Federal Facility Agreement and Site Treatment Plan.

- Continue Payments-in-Lieu-of-Taxes to Aiken, Allendale, and Barnwell counties.

- Provide independent environmental monitoring and emergency management activities.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

SR-0011C / NM Stabilization and Disposition	**361,343**	**391,625**	**370,042**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The H Area facilities will continue to stabilize and disposition enriched uranium materials through the middle of FY 2011. The materials planned and proposed to be dispositioned in H Area include: highly-enriched uranium solutions; miscellaneous fuels; plutonium residues; enriched uranium residues; and other legacy materials identified by DOE. These facilities will be deactivated by the end of FY 2023. Funding for the Highly Enriched Uranium Blend Down program, which was previously funded by the National Nuclear Security Administration, are included in this PBS. These facilities also have the capability to disposition certain plutonium materials through the liquid waste system.

This PBS scope also includes the Receiving Basin for Off-Site Fuels facility which has been de-inventoried, deactivated and placed in long-term surveillance.

Additional scope in this PBS is the operation of K-Area as a storage and surveillance facility for stabilized special nuclear materials. The receipt, storage, and disposition of materials at the Savannah River Site allows for de-inventory and shutdown of other DOE complex sites, providing substantial risk reduction and significant mortgage reduction savings to the Department.

The K Reactor process area will be maintained in a safe and environmentally sound shutdown condition. The K-Area will continue to serve as a material storage facility for unirradiated highly enriched uranium, tritiated heavy water, and plutonium. The K-Area Material Storage Facility will also continue to serve as an International Atomic Energy Agency control protocol facility for plutonium oxide.

The K-Area Interim Surveillance capability to perform destructive and non-destructive surveillance in accordance with DOE Standard-3013 is being installed in K-Area. The DOE STD-3013 surveillance and repackaging capability will be operated for management of legacy inventories within the K-Area Material Storage Facility. Plutonium that meets the criteria for disposition via the DOE mixed-oxide fuel program may be transferred for disposition by FY 2019.

DOE plans to ship surplus non-pit weapons-grade plutonium to the Savannah River Site from the Los Alamos National Laboratory, and Lawrence Livermore National Laboratory. This material will be received and stored at K-Area Material Storage.

In FY 2011, the following activities are planned:

- Continue to receive weapons grade surplus non-pit plutonium from the Los Alamos National Laboratory, and Lawrence Livermore National Laboratory.
- Perform surveillance of materials in storage in accordance with DOE-STD-3013 and the surveillance and monitoring plan.
- Continue surveillance and maintenance of the F Area Materials Storage Facility (235-F) as well as for the Receiving Basin for Off-Site Fuels Facility. Develop a program to reduce the risk to personnel and the environment by reducing the residual plutonium-238 contamination in the F Area Materials Storage Facility (235-F).
- Continue processing nuclear materials as well as purchase of cold chemicals and other materials for operations of H Canyon and HB Line.
- Support L to H shipments to H Canyon.
- Perform H Canyon/HB Line infrastructure upgrades.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Enriched Uranium packaged for disposition (Number of Containers)	3,085	3,184	3,184	3,184	100.0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	11,536	11,536	11,536	23,182	50.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete Superkukla processing pending DOE Government Furnished Services and Items release of material for processing (FY 2009)
- Complete Conceptual Design Plutonium Preparation Project (FY 2009)
- Continue disposition of depleted uranium oxide (FY 2009)
- Continued surveillance capability of 3013 cans in compliance with DOE-STD-3013 (FY 2009/September 2011)
- Continued operations of the K Area Material Storage Facility (FY 2009/ September 2011)

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Complete Dissolution and Purification of Un-irradiated Highly Enriched Uranium (March 2011)
- Develop a program to reduce the residual plutonium-238 contamination in F Area Materials Storage Facility (235-F) (September 2011)

	FY 2009	FY 2010	FY 2011
SR-0012 / SNF Stabilization and Disposition	**30,662**	**38,768**	**23,194**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS covers the scope and funding for the legacy spent nuclear fuel originating from Atomic Energy Commission and DOE activities, and non-legacy spent nuclear fuel, originating in both Foreign and Domestic Research Reactors (including Gap Material) which is being transferred to the Savannah River Site for safe, secure storage pending disposition. All spent fuel activities at Savannah River are conducted in a single area and consolidated for storage in a single basin.

This PBS also includes 1,600 metric tons of heavy water stored in various locations that will be dispositioned by the end of FY 2020. Some of the heavy water is significantly tritiated. Disposition alternatives are being explored. All deactivation activities under this PBS are scheduled to be completed by FY 2022 and the facilities transferred to PBS SR-0040C, Nuclear Facility Decontamination and Decommissioning.

In FY 2011, the following activities are planned:

- Facility surveillance and maintenance activities, including maintenance of equipment, facility, grounds, instrumentation, and infrastructure.
- Provide safe storage of all spent nuclear fuel.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	3	3	3	40	8.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Spent Nuclear Fuel Receipts - Receive Foreign Research Reactor Fuel, receive Domestic Research Reactor Fuel. (FY 2009)
- Maintain L Area spent nuclear fuel receipt, storage, and shipping facilities in an operable condition capable of supporting planned program requirements. (FY 2009)
- Ship Spent Nuclear Fuel to H-Area (April 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
SR-0014C / Radioactive Liquid Tank Waste Stabilization and Disposition-2035	**731,774**	**761,256**	**806,233**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS supports the mission of the tank waste program at the Savannah River Site, to safely and efficiently treat, stabilize, and dispose of approximately 37 million gallons of legacy radioactive waste currently stored in 49 underground storage tanks.

The Savannah River Site plans to: reduce the volume of tank waste by evaporation to ensure that storage tank space is available to receive additional legacy waste from ongoing nuclear material stabilization and waste processing activities; pre-treat the radioactive waste as sludge and salt waste; vitrify sludge and high curie/high actinide high-level waste at the Defense Waste Processing Facility into canisters and then store the canisters; treat and dispose of the low-level tank waste as saltstone grout; treat and discharge evaporator overheads through the Effluent Treatment Project; empty and permanently close in place using grout all waste tanks and support systems; and ensure that risks to the environment and human health and safety from tank waste operations are eliminated or reduced to acceptable levels.

To comply with state and federal regulatory agreements, all storage tanks must be empty by 2028. This project also includes the design, construction, and operation of the Salt Waste Processing Facility to safely separate the high-activity fraction from the low-activity fraction of the salt waste stored in underground tanks at Savannah River. Processing salt waste through the Salt Waste Processing Facility is planned to begin in FY 2013 to maintain adequate tank space required to support Defense Waste Processing Facility operations, expedite processing of liquid waste consistent with the current strategy, and ensure that the site meets its Federal Facilities Agreement commitments for tank waste disposition. Interim salt processing operations are on going using the Modular Caustic Side Solvent Extraction Unit and the Actinide Removal Process until the Salt Waste Processing Facility starts in FY 2013 to ensure enough tank space is generated to support the Defense Waste Processing Facility feed preparation and tank closure activities.

For the Salt Waste Processing Facility (05-D-405), a total of $155,524,000 for construction was appropriated in FY 2009 and $234,118,000 was appropriated in FY 2010 and $256,951,000 is requested in FY 2011 to continue construction.

In FY 2011, the following activities are planned:

- Continue operation of interim salt processing facilities.
- Support H Canyon receipts of newly generated waste.
- Continue operation of the Defense Waste Processing Facility and complete 297 canisters of glass waste.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Continue construction of the Salt Waste Processing Facility.
- Continue operation of F and H Tank Farms.
- Continue Bulk Waste Removal operations in order to meet a Federal Facilities Agreement commitment in FY 2011 and to support the Defense Waste Processing Facility feed preparation, Actinide Removal Process and Modular Caustic Side Extraction feed preparation, as well as support of tank closure activities.
- Support Tank 48 Return to Service Project.
- Support tank closure activities in order to meet Federal Facility Agreement commitments in FY 2012.
- Continue saltstone production and disposal operations as well as vault construction.
- Continue the Effluent Treatment Facility operations.
- Continue modifications to liquid waste facilities, systems, and waste transfer lines in support of the Salt Waste Processing Facility project.
- Initiate Glass Waste Storage Building #3 project planning.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Liquid Waste in Inventory eliminated (Thousands of Gallons)	2,110	2,810	3,510	33,100	11.0%
Liquid Waste Tanks closed (Number of Tanks)	2	2	4	51	8.0%
High-Level Waste packaged for final disposition (Number of Containers)	2,795	2,981	3,278	6,300	52.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete Enhanced Final Design (FY 2009)
- Complete Mechanical Cleaning of Tanks 18 and 19 (FY 2009)
- Complete Basemat – Central Processing Area (FY 2009)
- Complete Processing Low Organic Salt Waste Processing (FY 2009)
- Complete Deck at 116' - Central Processing Area (April 2010)
- Complete Delivery - Large ASME Vessels (August 2010)
- Submit F Tank Farm Draft Waste Determination Basis Document to the Nuclear Regulatory Commission (September 2010)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Complete Bulk Waste Removal Operations for 2 Tanks (September 2010)
- Produce 186 Canisters of Vitrified High Level Waste (September 2010)
- Complete Dark Cells Deck at 139' – Central Processing Area (April 2011)
- Produce 297 Canisters of Vitrified High Level Waste (September 2011)

	FY 2009	FY 2010	FY 2011
Total, Savannah River	**1,222,743**	**1,209,949**	**1,217,799**

Explanation of Funding Changes

In FY 2011, EM is proposing to transfer existing PBSs from the currently established control points of 2035 Completions, Nuclear Material Stabilization and Disposition, and Tank Farm Activities to newly created control points of Cleanup and Waste Disposition and Site Risk Management Operations. These new controls points are being proposed in order to better align EM activities with our overall cleanup strategy at the site.

The Explanation of Funding Changes Table below has been comparably adjusted to reflect the PBSs within the new control points in order to aid in the review process.

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Savannah River Site	
Cleanup and Waste Disposition	
SR-0100 / Savannah River Community and Regulatory Support	
▪ No significant change.	30
Site Risk Management Operations	
SR-0011C / NM Stabilization and Disposition	
▪ Decrease is associated with a completion of the californium shuffler and one time funding for the K Area purification vault in FY 2010.	-21,583
SR-0012 / SNF Stabilization and Disposition	
▪ Decrease is due to the elimination of foreign and domestic fuel shipment receipts.	-15,574
SR-0014C / Radioactive Liquid Tank Waste Stabilization and Disposition-2035	

	FY 2011 vs. FY 2010 ($000)
- Increase is due to an increase to the Tank 48 Return to Service Project and Bulk Waste Removal to support tank closure acceleration.	44,977
Total, Savannah River	**7,850**

Salt Waste Processing Facility, Savannah River Site, Aiken, South Carolina
(Construction 05-D-405) - (SR-0014C)

1. Significant Changes

In an Energy Systems Acquisition Advisory Board briefing on December 8, 2008, the Deputy Secretary of Energy approved Critical Decision 3 with a total project cost of $1,339,548,586 for the Salt Waste Processing Facility. A Federal Project Director, Level IV has been assigned to this project. This project data sheet is an update of the fiscal year 2010 project data sheet.

2. Design, Construction, and D&D Schedule

(fiscal quarter or date)

	CD-0	CD-1	PED Complete	CD-2	CD-3	CD-4	D&D Start	D&D Complete
FY 2005	06/25/2001	4Q FY2004	4Q FY2005	4Q FY2005	4Q FY2005	4Q FY2008	N/A	N/A
FY 2006	06/25/2001	4Q FY2004	3Q FY2006	3Q FY2006	3Q FY2006	4Q FY2009	N/A	N/A
FY 2007	06/25/2001	4Q FY2004	1Q FY2008	3Q FY2007	3Q FY2007	1Q FY2011	N/A	N/A
FY 2008	06/25/2001	4Q FY2004	1Q FY2008	3Q FY2007	3Q FY2007	1Q FY2011	N/A	N/A
FY 2007 Notification	06/25/2001	4Q FY2004	4Q FY2008	4Q FY2007	4Q FY2008	1Q FY2014	N/A	N/A
FY 2009	06/25/2001	4Q FY2004	4Q FY2008	4Q FY2007	4Q FY2008	1Q FY2014	N/A	N/A
FY 2008 Reprogramming	06/25/2001	4Q FY2004	4Q FY2008	4Q FY2007	1Q FY2009	1Q FY2014	N/A	N/A
FY 2010	06/25/2001	4Q FY2004	4Q FY2008	4Q FY2007	1Q FY2009	1Q FY2016	N/A	N/A
FY 2011	06/25/2001	4Q FY2004	4Q FY2008	4Q FY2007	1Q FY2009	1Q FY2016	N/A	N/A

CD-0 – Approve Mission Need
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout
D&D Start – Start of Demolition & Decontamination (D&D) work
D&D Complete – Completion of D&D work

	(Fiscal Quarter or Date)							
	Performance Baseline Validation	CD-2/3A	CD-3B	CD-3				
FY 2005	N/A	N/A	N/A	N/A				
FY 2006	N/A	N/A	N/A	N/A				
FY 2007	N/A	N/A	N/A	N/A				
FY 2008	N/A	N/A	N/A	N/A				
FY 2007 Notification	4Q2007	4Q2007	2Q2008	N/A				
FY 2009	4Q2007	4Q2007	3Q2008	N/A				
FY 2008 Reprogramming	4Q2007	4Q2007	4Q2008	N/A				
FY 2010	4Q2007	4Q2007	4Q2008	1Q2009				
FY 2011	4Q2007	4Q2007	4Q2008	1Q2009				

CD-2/3A - Site Preparation, Early Construction and Long Lead Procurement
CD-3B - Early Construction and Long Lead Procurement

3. Baseline and Validation Status

(Fiscal Quarter)

	TEC, PED	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2005	TBD	TBD	TBD or N/A	TBD	N/A	TBD or N/A	TBD or N/A
FY 2006	78,917	252,014	330,931	107,207	0	107,207	438,138
FY 2007	228,600	331,000	559,600	120,400	0	120,400	680,000
FY 2008	228,705	497,199	725,904	173,433	0	173,433	899,337
FY 2007 Notification	228,797	497,199	725,996	173,341	0	173,341	899,337
FY 2009	228,705	497,199	725,904	173,433	0	173,433	899,337
FY 2008 Reprogramming	243,705	482,199	725,904	173,433	0	173,433	899,337
FY 2010	243,705	895,151	1,138,856	200,692	0	200,692	1,339,548
FY 2011	243,705	895,151	1,138,856	200,692	0	200,692	1,339,548

4. Project Description, Justification, and Scope

This project scope includes construction of a facility to treat large quantities of waste from reprocessing and other liquids generated by nuclear materials production operations at the Savannah River Site. Approximately 37,000,000 gallons of this waste is being stored on an interim basis in 49 underground waste storage tanks. Of the 37,000,000 gallons, approximately 3,000,000 gallons are sludge waste and approximately 34,000,000 gallons are salt waste, consisting of 16,500,000 gallons of solid saltcake and 17,500,000 gallons of salt supernate. Waste volumes are subject to change because the supernate is evaporated to reduce its volume, sludge is being removed for processing and vitrification, and new waste is being transferred to the radioactive liquid waste tanks. In addition, water required for salt cake removal from the tanks and processing is presently expected to result in approximately 84 million gallons of salt and supernate solution to be processed. Continued, long-term storage of this liquid waste in underground tanks poses an environmental risk.

To comply with state and federal regulatory agreements, all non-compliant storage waste tanks must be empty by 2028. The Department built the Defense Waste Processing Facility to vitrify radioactive liquid waste into a stable form and store it for eventual disposal in a geologic repository. The ability to safely process the salt component of the radioactive liquid waste stored in underground storage tanks at the Savannah River Site is a crucial prerequisite for completing radioactive liquid waste disposal. Without a suitable method for salt management, the Department would not be able to place the radioactive liquid waste in a configuration acceptable for safe disposal.

This project scope includes design, construction, and cold commissioning of the Salt Waste Processing Facility, to safely separate the high-activity fraction from the low-activity fraction of the radioactive liquid salt waste stored in underground tanks at the Savannah River Site. The Department has selected Caustic-Side Solvent Extraction as the preferred technology for separation of radioactive cesium from the salt wastes. Salt Waste Processing Facility processing also includes a separation step to remove strontium, uranium, plutonium and neptunium from the waste by sorption onto granular monosodium titanate followed by filtration.

The Salt Waste Processing Facility presently has a waste processing nameplate capacity of a nominal 7.3 million gallons per year. The Salt Waste Processing Facility will consist of all buildings, equipment, and services required to provide a fully functioning facility for processing salt waste. The Salt Waste Processing Facility will contain necessary process areas, service areas, chemical storage areas, and administrative areas. The process building will contain shielded processing cells and chemical processing equipment. Incell tanks and components will be of a closed-cell design for ease of maintenance, replacement, and later decommissioning. The operating area will contain chemical feed pumps and tanks, hot and cold laboratories for testing samples, electrical and mechanical equipment areas, truck unloading area, and maintenance and decontamination areas. The chemical storage area will be located near the process building and will contain chemical storage tanks. Service and administrative spaces will be sized as required to accommodate the process facility.

A formal technical and programmatic risk assessment has been performed. The risk assessment concluded that the technical and programmatic risks are manageable.

The Savannah River Site Federal Facilities Agreement and Site Treatment Plan require production of (on average) 200 high-level waste canisters per year at the Defense Waste Processing Facility. In order to minimize total canister production and avoid future shutdowns or slowdowns of the Defense Waste Processing Facility, a coupled feed (both sludge and salt) must be established and maintained. At this time, the Salt Waste Processing Facility is on the critical path for establishing the coupled feed.

In response to Defense Nuclear Facility Safety Board concerns on radiological materials, the Department of Energy Savannah River Operations Office directed development of an Enhanced Preliminary Design that implemented a Performance Category 3 confinement approach on November 23, 2005.

In May 2007, development of a bottoms-up cost estimate was completed to support the Critical Decision-2 package, and further adjusted based on comments received from an External Independent Review, which resulted in a project cost estimate of $899,337,000. The primary drivers for this $220 million increase over the rough order of magnitude estimate were increased technical requirements resulting from the implementation of National Quality Assurance Standard 1 in lieu of International Standards Organization Standard 9001, resolution of structural/geotechnical issues, and additional Performance Category 3 requirements not identified during the initial rough order of magnitude estimate process. In addition, changes in how the project interpreted guidance on classification of Operating Funds as either Other Project Costs or Operating Costs accounted for approximately $53 million of the $220 million increase.

Early in the execution of Critical Decision 2/3A activities, design issues surrounding inability to secure sufficient critical design resources began to impact completion of design activities. This situation was further exacerbated by the volatility of the market, which began affecting the Critical Decision 3A procurements. Mitigation strategies were developed to deal with these issues. The revised Critical Decision 3 baseline was developed using the 90 percent design drawings, which required additional material and associated labor to install, and incorporating the cost of realized risk of material cost increases and design delays. As a result of the new baseline and additional funding required to adequately address risks, the total project cost for the Salt Waste Processing Facility is $1,339,548,586, an increase of $440,211,586 over the Critical Decision 2 baseline estimate.

Cost and schedule confidence levels were established at Critical Decision 3. The 80 percent confidence completion date is October 2015, which includes 126 weeks of schedule contingency. At the 95 percent confidence cost is $1,340 million.

Critical Decision - 0: Approve Mission Need - June 2001

Critical Decision - 1: Approve Preliminary Baseline Range - August 2004

Independent Review of Contractors Earned Value Management System - June 2005 (with a follow-up review in January 2008)

Critical Decision - 2/3a: Approve Performance Baseline/ Start of Construction (Long Lead Procurement/Site Preparation/Limited Construction) - September 2007

Critical Decision - 3b: Start of Construction (Long Lead Procurement/Limited Construction) - September 2008

Critical Decision - 3: Approve Start of Construction - December 2008

Critical Decision - 4: Approve Start of Operations - October 2015

The project is being conducted in accordance with the project management requirements in DOE O 413.3A and DOE M 413.3-1, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

5. Financial Schedule

(dollars in thousands)

	Appropriations	Obligations	Costs
Total Estimated Cost (TEC)			
PED			
FY 2003	4,842	4,842	0
FY 2004	51,198	51,198	11,539
FY 2005	23,469	23,469	30,204
FY 2006	34,990	34,990	48,195
FY 2007	104,296	104,296	75,600
FY 2008	24,910	24,910	57,863
FY 2009	0	0	16,588
FY 2010	0	0	3,716
Total, PED	243,705	243,705	243,705
Construction			
FY 2005	5,792	5,792	0
FY 2006	495	495	0
FY 2007	0	0	1,907
FY 2008	72,199	72,199	63,640
FY 2009	155,524	155,524	93,367
FY 2010	234,118	234,118	255,944
FY 2011	256,951	256,951	278,777
FY 2012	170,071	170,071	191,897
FY 2013	1	1	9,619
Total, Construction	895,151	895,151	895,151
TEC			
FY 2003	4,842	4,842	0
FY 2004	51,198	51,198	11,539
FY 2005	29,261	29,261	30,204
FY 2006	35,485	35,485	48,195
FY 2007	104,296	104,296	77,507
FY 2008	97,109	97,109	121,503
FY 2009	155,524	155,524	109,955
FY 2010	234,118	234,118	259,660
FY 2011	256,951	256,951	278,777
FY 2012	170,071	170,071	191,897
FY 2013	1	1	9,619
Total, TEC	1,138,856	1,138,856	1,138,856
Other Project Cost (OPC)			
OPC except D&D			
FY 2006	22,447	22,447	22,447
FY 2007	9,048	9,048	9,048
FY 2008	9,715	9,715	7,715
FY 2009	13,133	13,133	9,729
FY 2010	25,202	25,202	26,553
FY 2011	30,605	30,605	31,956
FY 2012	32,579	32,579	33,930
FY 2013	57,963	57,963	59,314
FY 2014	0	0	0

(dollars in thousands)

	Appropriations	Obligations	Costs
Total, OPC except D&D	200,692	200,692	200,692
OPC			
FY 2006	22,447	22,447	22,447
FY 2007	9,048	9,048	9,048
FY 2008	9,715	9,715	7,715
FY 2009	13,133	13,133	9,729
FY 2010	25,202	25,202	26,553
FY 2011	30,605	30,605	31,956
FY 2012	32,579	32,579	33,930
FY 2013	57,963	57,963	59,314
FY 2014	0	0	0
Total, OPC	200,692	200,692	200,692
Total Project Cost (TPC)			
FY 2003	4,842	4,842	0
FY 2004	51,198	51,198	11,539
FY 2005	29,261	29,261	30,204
FY 2006	57,932	57,932	70,642
FY 2007	113,344	113,344	86,555
FY 2008	106,824	106,824	129,218
FY 2009	168,657	168,657	119,684
FY 2010	259,320	259,320	286,213
FY 2011	287,556	287,556	310,733
FY 2012	202,650	202,650	225,827
FY 2013	57,964	57,964	68,933
FY 2014	0	0	0
Total, TPC	1,339,548	1,339,548	1,339,548

FY 2008: Includes a Congressional Reprogramming of $15,000,000 from the construction project (05-D-405) to Project Engineering and Design (03-D-414)

6. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design (PED)			
Design	234,085	234,085	206,705
Contingency	9,620	9,620	37,000
Total, PED	243,705	243,705	243,705
Construction			
Site Preparation	27,263	27,263	27,263
Equipment	141,000	141,000	89,508
Other Construction	492,128	492,128	316,428
Contingency	234,760	234,760	49,000
Total, Construction	895,151	895,151	482,199
Total, TEC	1,138,856	1,138,856	725,904

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Contingency, TEC	244,380	244,380	86,000
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	0	0	0
Conceptual Design	14,133	14,133	14,445
Start-Up	117,724	117,724	96,940
Contingency	30,450	30,450	22,000
Other OPC	38,385	38,385	40,048
Total, OPC except D&D	200,692	200,692	173,433
D&D			
D&D	0	0	0
Contingency	0	0	0
Total, OPC	200,692	200,692	173,433
Contingency, OPC	30,450	30,450	22,000
Total, TPC	1,339,548	1,339,548	899,337
Total, Contingency	274,830	274,830	108,000

7. Funding Profile History

Request		Prior Years	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Out-years	Total
FY 2004	TEC	69,000	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	11,967	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	80,967	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2005	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FY 2006	TEC	336,040	0	0	0	0	0	0	0	336,040
	OPC	103960	0	0	0	0	0	0	0	103,960
	TPC	440,000	0	0	0	0	0	0	0	440,000
FY 2007 Performance Baseline	TEC	559,600	0	0	0	0	0	0	0	559,600
	OPC	120,400	0	0	0	0	0	0	0	120,400
	TPC	680,000	0	0	0	0	0	0	0	680,000
FY 2008	TEC	455,987	103,613	0	0	0	0	0	0	559,600
	OPC	44,000	5,000	71,400	0	0	0	0	0	120,400
	TPC	499,987	108,613	71,400	0	0	0	0	0	680,000
FY 2007 Congressional Notification	TEC	493,608	100,000	95,300	28,532	8,556	0	0	0	725,996
	OPC	55,061	20,726	25,652	56,887	11,960	3,055	0	0	173,341
	TPC	548,669	120,726	120952	85,419	20,516	3,055	0	0	899,337
FY 2009	TEC	449,715	133,247	105,854	28,532	8,556	0	0	0	725,904
	OPC	55,061	20,726	25,652	56,887	11,960	3,147	0	0	173,433
	TPC	504,776	153,973	131,506	85,419	20,516	3,147	0	0	899,337
	TEC	477,715	234,118	256,951	170,071	1	0	0	0	1,138,856

FY 2010	OPC	54,343	25,202	30,605	32,579	57,963	0	0	0	200,692
	TPC	532,058	259,320	287,556	202,650	57,964	0	0	0	1,339,548
FY 2011	TEC	477,715	234,118	256,951	170,071	1	0	0	0	1,138,856
	OPC	54,343	25,202	30,605	32,579	57,963	0	0	0	200,692
	TPC	532,058	259,320	287,556	202,650	57,964	0	0	0	1,339,548

8. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY2016
Expected Useful Life (number of years)	17
Expected Future Start of D&D	N/A

(Related Funding requirements)

(Dollars in Thousands)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	63,443	61,686	1,083,957	960,425
Maintenance	10,785	10,686	184,273	184,975
Total, Operations & Maintenance	74,228	72,372	1,268,230	1,145,400

Start of Operation or Beneficial Occupancy (fiscal quarter or date): The operational start date above is based on data used to support the $1,339.5 million total project cost estimate and associated performance measurement baseline (early finish) completion date. Should the projected schedule contingency of 126 weeks be fully realized, then the start of operation milestone would move out to the first quarter of fiscal year 2016.

9. Required D&D Information

Area	Square Feet

This project is new construction which does not replace an existing facility. As part of the Office of Environmental Managements cleanup efforts, sites have established unique projects to perform Decontamination and Decommissioning. An estimated 2,200,000 square feet of buildings will have been removed from the Savannah River Sites inventory from fiscal year 2003 through fiscal year 2006. The square footage of this project will be offset against the Savannah River Site Decontamination and Decommissioning program's banked excess.

10. Acquisition Approach

The project acquisition strategy included the use of two separate contractors to perform conceptual design, which reduced project risk. Both contractors identified and managed technical and program risks through completion of conceptual design. Following completion of conceptual design, the Department selected one of the two contractors to perform preliminary and final design, construction, commissioning, and one year of operations. Design services were obtained through a competed contract with an Engineering, Procurement, and Construction contractor. The negotiated contract is a Cost-Plus-Incentive Fee arrangement, which also includes construction and commissioning services. Management and Operating contactor staff will be involved in areas concerning high level waste system interfaces, feed, and product specifications, etc.

Closure Sites

Funding by Site and Location

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Closure Sites				
Closure Sites Administration	13,209	0	8,225	6,375
Fernald	2,100	0	0	0
Miamisburg	30,574	19,700	33,243	0
Total, Closure Sites	45,883	19,700	41,468	6,375

The Mound site will be completed by the end of FY 2010. Total operational management of the long-term stewardship mission at the Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

Mound

Site Overview

The Miamisburg Mount Plant was built in the late 1940s to support research and development, testing, and production activities for DOE's defense nuclear weapons complex and energy research programs. The Miamisburg Closure Project contractor declared physical completion of environmental cleanup on July 31, 2006, and DOE accepted completion of that scope in March 2007. Subsequently, Congress directed additional remediation of Operable Unit 1 at this site. The Miamisburg Closure Project will be completed in FY 2010 and total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011 to include total funding transfer of $27,603,000.

American Recovery and Reinvestment Act (ARRA) Activities

The Mound American Recovery and Reinvestment Act activities are funded at $19,700,000. American Recovery and Reinvestment Act funding will be used for remediation of Operable Unit 1 (historic landfill). Work at the site will result in the completion of the necessary excavation, waste management and disposal of the contaminated soils, provide verification samples and reports, backfill, and accomplish site restoration of the Operable Unit 1 Project Area to acceptable standards.

Site Description

The Miamisburg Closure Project site is located in Miamisburg, Ohio, 10 miles southwest of Dayton and 31 miles north of Cincinnati. The Miamisburg Mound plant's mission involved production of components, which contained plutonium-238, polonium-210, tritium, and large quantities of high explosives. This mission continued until 1994, when these activities were transferred to other DOE facilities.

Site Cleanup Strategy/Scope of Cleanup

Solid waste stabilization and disposition activities included the collection, storage, and disposition of waste, primarily waste generated from contaminated soil cleanup and waste from the decontamination and demolition of site buildings, including low-level waste, low-level mixed waste, transuranic waste, hazardous waste, and solid waste streams. Soil and building contamination was dominated by residual spread of thorium and plutonium. The site contractor declared physical completion in July 2006.

Operable Unit 1 (Historic Landfill) met the requirements under Comprehensive Environmental Response, Compensation, and Liability Act and had been accepted by the United States Environmental Protection Agency and Ohio Environmental Protection Agency. However, in FY 2006 Congress directed DOE to develop a mutually acceptable remedy with the Miamisburg Mound Community Improvement Corporation for Operable Unit 1 with an appropriation not to exceed $30,000,000. A prioritized exhumation was the agreed upon remedy. Subsequently, a competitive procurement took place in FY 2006 and the EM Consolidated Business Center awarded an Indefinite Delivery/Indefinite Quantity contract in October 2006. During FY 2007, an additional $4,500,000 was provided from available project funds to support additional remediation of high priority Operable Unit 1 areas. The available funds were expended and the site was returned to a protective state in FY 2008. In the FY 2009 Omnibus Budget, Congress provided an additional $4,757,500 and the American Recovery and Reinvestment Act provided $19,700,000 to resume the remediation of the Operable Unit 1 landfill to a level which will allow for the removal of an anticipated Environmental Protection Agency "No Dig" restriction. This is a Miamisburg Mound Community Improvement Corporation stipulation for their acceptance of the transfer of the Operable Unit 1 land parcel.

Final site remediation is projected in September 2010, including Operable Unit 1. Total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

Site Completion (End State)

The site contractor declared physical completion of the Miamisburg Closure Project in July 2006, and DOE completed their physical acceptance review and declared physical acceptance in March 2007. The Office of Legacy Management assumed operational control responsibility for the site in October 2006 and will assume total operational management of the long-term stewardship mission at Miamisburg Closure Project in FY 2011.

Regulatory Framework

In 1993 DOE/United States Environmental Protection Agency and the Ohio Environmental Protection Agency signed the Federal Facility Agreement.

Critical Site Uncertainties and Assumptions

Total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

Interdependencies

Wastes generated through remediation of Operable Unit 1 require commercial off-site disposal.

Contract Synopsis

An Indefinite Delivery/Indefinite Quantity contract with Accelerated Remediation Company for the Operable Unit 1 and Potential Release Site 441 was awarded in October 2006, and was planned to be completed in April 2008. Potential Release Site 7 scope was added to the Accelerated Remediation Company contract and was completed in 2009. As a result of additional funding provided by Congress and the American Recovery and Reinvestment Act in FY 2009, remediation of the Operable Unit 1 Landfill was resumed and will be completed in late FY 2010. Total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

Cleanup Benefits

Closure and turnover of 24 buildings and 306 acres to the Miamisburg Mound Community Improvement Corporation were expected to be completed by the end of FY 2008. However, the Miamisburg Mound Community Improvement Corporation indicated they would not accept any portion of the Operable Unit 1 site which includes a Comprehensive Environmental Response, Compensation, and Liability Act no-dig restriction. As a result, additional funding was provided in FY 2009 to resume remediation of the Operable Unit 1 area. It is expected that this level of funding will be sufficient to remove the no-dig restriction and that the Miamisburg Mound Community Improvement Corporation will accept the parcel of land containing Operable Unit 1. Total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Closure Sites			
CBC-0100-RF / CBC Post Closure Administration - Rocky Flats	9,302	6,375	6,375
CBC-0100-FN / CBC Post Closure Administration - Fernald	2,019	1,850	0
CBC-0100-MD / CBC Post Closure Administration - Mound	1,888	0	0
OH-FN-0030 / Soil and Water Remediation-Fernald	2,100	0	0
OH-MB-0030 / Soil and Water Remediation-Miamisburg	4,224	5,097	0
OH-MB-0100 / Miamisburg Post-Closure Administration	26,350	28,146	0
Subtotal, Closure Sites	45,883	41,468	6,375
Total, Defense Environmental Cleanup	45,883	41,468	6,375
Total, Closure Sites	45,883	41,468	6,375

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
Closure Sites					
Geographic Sites Eliminated (number of sites)	6	6	6	6	100.0%
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	0	100.0%
Industrial Facility Completions (Number of Facilities)	441	441	441	441	100.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	616,927	616,927	616,927	616,927	100.0%
Material Access Areas eliminated (Number of Material Access Areas)	7	7	7	7	100.0%
Nuclear Facility Completions (Number of Facilities)	15	15	15	15	100.0%
Plutonium Metal or Oxide packaged for long-term storage (Number of Containers)	1,895	1,895	1,895	1,895	100.0%
Plutonium or Uranium Residues packaged for disposition (Kilograms of Bulk)	103,901	103,901	103,901	103,901	100.0%
Radioactive Facility Completions (Number of Facilities)	136	136	136	136	100.0%
Remediation Complete (Number of Release Sites)	549	549	549	549	100.0%
Transuranic Waste shipped for disposal (Cubic meters) - CH	15,036	15,036	15,036	15,036	100.0%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
CBC-0100-FN / CBC Post Closure Administration - Fernald	**2,019**	**1,850**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This Post-Closure Administration PBS scope includes the Fernald Closure Project regulatory support, Human Resource Management, Budget and Financial support, and administration of Freedom of Information and Privacy Act programs at the Fernald closure site.

In FY 2011, the following activities are planned:

- No activities are planned for the Fernald Project.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)
▪ Complete record-of-decision for final disposition of waste currently held at WCS facility in Texas (October 2009)

	FY 2009	FY 2010	FY 2011
CBC-0100-MD / CBC Post Closure Administration - Mound	**1,888**	**0**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This Post-Closure Administration PBS provides funding for the Mound Closure Project regulatory support, Human Resource Management, Budget and Financial support, and administration of Freedom of Information and Privacy Act programs at the closure site.

In FY 2011, the following activities are planned:

- Transfer to the Office of Legacy Management in FY 2011.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
CBC-0100-RF / CBC Post Closure Administration - Rocky Flats	**9,302**	**6,375**	**6,375**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The scope of this PBS is to provide site litigation support related to the continuing class actions and other civil litigation activities of former site contractors. This support does not include closure contract litigation support costs incurred by the Rocky Flats site closure contractor.

The Rocky Flats Closure Project achieved site closure in FY 2006. However, ongoing litigation support will continue until all litigation involving the Department of Energy or former Rocky Flats contractors is resolved. The EM Consolidated Business Center has assumed responsibility for the litigation associated with the Rocky Flats Site.

All litigations associated with the Rocky Flats Site are planned to be completed in FY 2011.

In FY 2011, the following activities are planned:

- Fund the end of the Rocky Flats Closure Project's legal requirements and court orders.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

OH-FN-0030 / Soil and Water Remediation-Fernald **2,100** **0** **0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The Soil and Water Remediation Project includes the characterization, remediation, and certification of all environmental media (soil, below-grade debris, and water). As of October 2006, Fernald had completed 100 percent of the contractually required remediation work.

In FY 2011, the following activities are planned:

- No activities are planned for the Fernald Project.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	2	2	2	2	100.0%

OH-MB-0030 / Soil and Water Remediation-Miamisburg **4,224** **5,097** **0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This project remediates contaminants that were released into the environment during operation of the Mound Plant from 1940 through 1994. The site contractor declared physical completion of the Miamisburg Closure Project in July 2006, and DOE completed their physical acceptance review and declared physical acceptance in March 2007. The Office of Legacy Management will assume full operational responsibility for the site in FY 2011.

In FY 2011, the following activities are planned:

- Transfer to the Office of Legacy Management in FY 2011.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Depleted and Other Uranium packaged for disposition (Metric Tons)	0	0	0	0	100.0%
Remediation Complete (Number of Release Sites)	178	178	178	178	100.0%

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OH-MB-0100 / Miamisburg Post-Closure Administration	**26,350**	**28,146**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS supported Post-Closure Contract liabilities such as pension, retiree medical and life insurance. This scope is defined under Financial Accounting Standard 87 (Employers' Accounting for Pension), Financial Accounting Standard 106 (Employers' Accounting for Post-Retirement Benefits Other Than Pension), and estimated workers' compensation. Total operational management of the long-term stewardship mission at Miamisburg Closure Project will be transferred to DOE's Office of Legacy Management in FY 2011.

In FY 2011, the following activities are planned:

- Transfer to the Office of Legacy Management in FY 2011.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
Total, Closure Sites	**45,883**	**41,468**	**6,375**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Closure Sites	
Closure Sites Administration	
CBC-0100-FN / CBC Post Closure Administration - Fernald	
▪ Decrease is due to a decrease in legal requirements, court orders and post-closure administrative costs.	-1,850
Miamisburg	
OH-MB-0030 / Soil and Water Remediation-Miamisburg	
▪ Project Completed. Decrease reflects the transfer of funding and responsibility for the Miamisburg Closure Project to the Office of Legacy Management.	-5,097
OH-MB-0100 / Miamisburg Post-Closure Administration	
▪ Project Completed. Decrease reflects the transfer of funding and responsibility for the Miamisburg Closure Project to the Office of Legacy Management.	-28,146
Total, Closure Sites	**-35,093**

NNSA Sites

Funding by Site and Location

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
NNSA Sites				
California Site Support	0	0	238	238
Nevada	75,674	44,325	65,674	66,000
NNSA Service Center/Separations Processing Research Unit (SPRU)	19,443	51,775	17,938	15,547
Lawrence Livermore National Laboratory	688	0	910	635
Los Alamos National Laboratory	224,639	211,775	196,500	196,953
Pantex	1,000	0	0	0
Sandia National Laboratories	3,000	0	2,864	0
Total, NNSA Sites	324,444	307,875	284,124	279,373

NNSA Sites

The Department's Office of Environmental Management is responsible for the safe and efficient cleanup of the environmental legacy at the following National Nuclear Security Administration Sites: Lawrence Livermore National Laboratory-Livermore Site 300, Los Alamos National Laboratory, Nevada Test Site, Pantex Plant, Sandia National Laboratories, and the Separations Process Research Unit.

The Pantex Plant was completed in FY 2009 and transitioned into long-term stewardship and was funded by the National Nuclear Security Administration beginning in FY 2009. Also in FY 2010, the environmental monitoring and maintenance of the majority of corrective measures implemented in previous years at Lawrence Livermore National Laboratory Site 300 became the responsibility of the National Nuclear Security Administration with the exception of one area Operable Unit 9 Building 812 at Lawrence Livermore National Laboratory Site 300, which extends the completion of Lawrence Livermore National Laboratory Site 300 to FY 2014.

Lawrence Livermore National Laboratory

Site Overview

Lawrence Livermore National Laboratory is a National Nuclear Security Administration multi-disciplinary research and development center focusing on weapons development and stewardship and homeland security. The only Environmental Management program remaining at Lawrence Livermore National Laboratory is the Site 300 environmental restoration project. Operable Unit 9 Bldg. 812 Firing Table will remain the responsibility of EM until remediation of this area is complete, currently scheduled for FY 2014.

Site Description

Lawrence Livermore National Laboratory Site 300 is an 8,000-acre site located about 15 miles east of Livermore, California with limited development, primarily used for explosive hydrodynamic testing and analysis of weapons components. The surrounding is a sparsely populated rural agricultural land. There is soil and groundwater contamination on-site and limited groundwater contamination off-site.

Site Cleanup Strategy/Scope of Cleanup

The cleanup strategy is a risk-based and regulatory compliant approach that focuses first on those contaminant plumes and sources that are the greatest contributors to risk. The overall goal is to ensure that risks to the public and workers are controlled, followed by work to clean up soil and groundwater using a risk-based methodology.

Site Completion (End State)

At completion, all required groundwater and/or soil vapor extraction and treatment facilities will have been constructed and fully operational. Groundwater monitoring and risk and hazard management will continue. Legacy waste will have been disposed of offsite and the Newly Generated Waste program will be transferred to National Nuclear Security Administration. The last remaining cleanup area is Operable Unit 9, the Building 812 Firing Table, currently scheduled for completion in FY 2014.

Near-Term Projects:

Site 300 Completion - Recent results of a characterization study at Operable Unit 9 Building 812 Firing Table, as discussed in the project's Risk Management Plan since 2004, indicated that contamination levels exceed cleanup standards in this area and the regulators have directed cleanup action be taken. A Remedial Investigation/Feasibility Study is currently under review by the regulatory agencies to define alternatives for the remediation needed in this area.

Regulatory Framework

The Environmental Restoration activities at Lawrence Livermore National Laboratory Site 300 are governed by a site-specific Comprehensive Environmental Response, Compensation and Liability Act, Federal Facility Agreement, signed in 1992. A Record of Decision was signed in 2008 establishing ground water cleanup standards for the site as the Federal drinking water Maximum Contaminant Level unless California State Maximum Contaminant Levels are more stringent.

Critical Site Uncertainties and Assumptions

At Site 300, the major uncertainty is the remediation of the depleted uranium contaminated soil at the Operable Unit 9 Building 812 Firing Table. The challenges of the project include the excavation of soil from very steep terrain, large volumes of soil to be remediated and potential impacts to endangered species habitat and surface water drainage ways in the area during excavation and remediation.

Contract Synopsis

The Management and Operating contract with the University of California for operation of Lawrence Livermore National Laboratory expired on September 30, 2007. DOE/National Nuclear Security Administration selected Lawrence Livermore National Security, LLC as the new Management and Operations contractor in a base-plus-incentive-fee contract that began on October 1, 2007. The cleanup work at Site 300 comprises elements of the new contract's performance measures.

Cleanup Benefits

Cleanup of the Lawrence Livermore National Laboratory site has led to the final disposition of legacy waste inventories and the construction of groundwater treatment facilities at the Lawrence Livermore National Laboratory Main Site.

All 22 of the required groundwater and soil vapor extraction and treatment facilities at Lawrence Livermore National Laboratory Site 300 have been constructed and are operational. The soil removal action at the Building 850 Firing Table will be completed in FY2010, and the Operable Unit 9 Building 812 Firing Table remediation is currently scheduled for completion in FY2014.

Los Alamos National Laboratory

Site Overview

Since its inception in 1943 as part of the Manhattan Project, the primary mission of the Los Alamos National Laboratory has been nuclear weapons research and development. In achieving this mission, the Laboratory released hazardous and radioactive materials to the environment through outfalls, stack releases, and material disposal areas. Mixed low-level waste and transuranic waste have been staged in preparation for off-site disposition. Since 1989, the Environmental Management program at Los Alamos National Laboratory has been comprised of activities to address the characterization and cleanup of environmental media (i.e., soil and groundwater), the disposition of legacy waste, and the decontamination and decommissioning of nuclear facilities that are in the path of environmental sites in need of characterization and remediation.

American Recovery and Reinvestment Act Activities

The Los Alamos National Laboratory American Recovery and Reinvestment Act (ARRA) activities are funded at $197,000,000 for Defense and $14,775,000 for Non-Defense. Specifically, this funding will support decontamination and decommissioning of original structures at the Los Alamos National Laboratory site as well as work to achieve compliance with the Consent Order between the Department of Energy and the New Mexico Environment Department. Activities include:

- Decontamination and decommissioning of facilities in DP West and East, dating to the Manhattan Project era.
- Characterizing the types and quantities of waste contained in the historical disposal pits and trenches as part of the Material Disposal Area-B cleanup project. This project meets a Consent Order Milestone required by New Mexico Environment Department to be completed by December 30, 2010.
- Installation of 17 new groundwater monitoring wells to support final characterization and corrective measures evaluations for contaminated sites
- Decontamination and decommissioning of the DP Site Tritium Systems Test and Assembly, which was used for polonium, actinide and tritium research and production, and for the civilian fusion reactor program.

Site Description

Los Alamos National Laboratory is located in north-central New Mexico, in Los Alamos County, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe. The site is approximately 40 square miles and is situated on the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep east-west-oriented canyons cut by streams. The surrounding land is largely undeveloped and large tracts of land North, West, and South of Los Alamos National Laboratory are held by other Federal agencies. In addition, there are four Native American Pueblos that border Los Alamos National Laboratory. There are four distinct geographical areas associated with the cleanup of Los Alamos National Laboratory:

- Town Site - This area includes solid waste management units associated with the Manhattan Project and early Cold War era Los Alamos National Laboratory operations and support. These sites are found on property currently owned by private citizens and local governments.

- Technical Area-21 -This work scope includes evaluation and implementation of corrective measures for material disposal areas A, T, U and V, the former process waste lines, and a broad category of environmental sites referred to as the Delta Prime Site Aggregate. This area served the process facilities in Delta Prime West and Delta Prime East including the Tritium Systems Test Assembly decontamination and decommissioning facility. Aggregates are areas defined in the enforceable State Compliance Order on Consent.

- Technical Area-54 - Former and active waste disposal areas for the Los Alamos National Laboratory are located at Technical Area-54, and the scope of work includes decontamination and decommissioning and the cleanup of several major material disposal areas (G, H, and L).

- Watersheds - There are eight watersheds across the Laboratory that collectively drains all run-offs from the Los Alamos National Laboratory to the Rio Grande. There are more than 650 sites within these eight Watersheds still requiring investigations and remediation.

Site Cleanup Strategy/Scope of Cleanup

Los Alamos National Laboratory has developed a comprehensive and detailed plan for cleanup of Environmental Management legacy waste sites at Los Alamos. This plan integrates the retrieval and disposition of legacy transuranic waste, decommissioning and decontamination of excess facilities at Technical Areas 21 and 54, and final remedy and site completion at approximately 860 remaining Solid Waste Management Units. The Los Alamos National Laboratory conducts assessments and corrective actions at contaminated sites to reduce unacceptable human health and ecological risks, and to reduce the inventory of legacy transuranic waste. The environmental restoration strategy is risk-based and complies with regulatory requirements to provide for future land use scenarios. The transuranic waste disposition strategy is to characterize, package, and ship waste to the Waste Isolation Pilot Plant. The strategy for decontamination and decommissioning and demolition of process-contaminated facilities at TA-21 and waste management facilities at TA-54 allows for characterization and cleanup of Solid Waste Management Units which are collocated in the footprint of the structures.

Site Completion (End State)

The end state for Environmental Management work is: (1) protection and monitoring of the regional aquifer which is the drinking water source for Los Alamos County; (2) cleanup of sites at Los Alamos National Laboratory and surrounding areas to levels appropriate for the intended land use; (3) decontamination, decommissioning, and removal of process contaminated facilities at TA-21 and waste management facilities at TA-54; (4) disposal of all legacy transuranic waste and mixed low-level waste from Los Alamos National Laboratory; and (5) installation of all long-term surveillance and monitoring systems. The lifecycle planning estimate for end date for cleanup is 2019.

Near-Term Projects:

Sediment Removal at LA-SMA-2 – LA-SMA-2 is an area of Polychlorinated Biphenyls and radioactive contamination identified during the characterization of the Upper Los Alamos Aggregate Area. Completion of this project is a requirement under the Consent Order and the completion milestone was added to the Stipulated Penalties list for FY 2010 by the New Mexico Environment Department.

TA-32 Cleanup Project – Supporting Los Alamos County re-development projects by completing cleanup of two Solid Waste Management Units identified as exceeding risk levels during the characterization of the Upper Los Alamos Aggregate Area.

Material Disposal Area H – This is an inactive 0.3-acre site used historically (1960 to 1986) for the disposal of classified solid-form waste. It consists of nine 60-foot deep shafts. The largest component of the inventory, 57 percent, is metal, both radioactive and non-radioactive (24 percent depleted uranium and 33 percent other metals). The Los Alamos National Laboratory has submitted an assessment of potential alternatives for cleanup. The New Mexico Environment Department is currently evaluating these alternatives and has the responsibility for selecting and defending a final remedy.

Cañon de Valle/260 Outfall - The Cañon de Valle/260 outfall includes the characterization and remediation at 140 Solid Waste Management Units/Areas of Concern located within Technical Areas-14, -15, and -16. These Solid Waste Management Units/Areas of Concern are expected to remain as industrial sites under DOE control for the foreseeable future. New Mexico Environment Department has required two wells to be abandoned, a well to be drilled and another deepened; in addition New Mexico Environment Department required an aquifer test work plan by February 2010. Groundwater well drilling was ongoing in FY 2009. The corrective measures implementation for the surface systems will start last quarter FY 2009 and continue through 2010.

Technical Area-21 - This project will characterize and remediate, if necessary, all Solid Waste Management Units within DP Site Aggregate at Technical Area-21, including characterization and construction of final remedies (engineered caps are assumed) at two material disposal areas (material disposal area A and T) and cleanup of three material disposal areas (material disposal area B, U, and V). The Consent Order completion milestone for the Los Alamos/Pueblo Watershed, which includes TA-21, is FY 2012.

Longer-Term Projects:

Corrective Actions - This project includes all investigations and subsequent remediation of Solid Waste Management Units intermixed with active Los Alamos National Laboratory operations. The investigation and cleanup activities for these Solid Waste Management Units (approximately 550) will be coordinated with managers for active mission projects to ensure no disruption of operations. This project includes Solid Waste Management Units in eight watersheds and 20 aggregate areas. The Consent Order requires completion of corrective actions at Sandia Watershed Aggregate Areas by January 2011; Mortandad Aggregate Areas by November 2012; Water Canyon/Canon de Valle, Pajarito, and Ancho/Chaquehui/Frijoles Aggregate Areas to be completed by September 2015.

Watershed Integration - The watershed integration work includes investigation and cleanup of the Canyons (sediments and alluvial groundwater), the investigation and remediation of contaminant plumes found in the intermediate and groundwater aquifers, interim monitoring and reporting of groundwater monitoring data as part of the Facility-Wide Groundwater Monitoring Project. Watershed integration also executes the storm water management project to assess contaminant transport driven by storm events and takes remedial action to maintain compliance with requirements driven by the Individual Permit issued by the U. S. Environmental Protection Agency. Work conducted for the canyons and site-wide monitoring aggregates are driven by the Consent Order, whereas the Facilities Compliance Agreement and Administrative Order requirements (pending issuance of an individual permit) are separate from the Consent Order. Routine groundwater monitoring conducted in 2005 led to the identification of chromium contamination in regional groundwater at monitoring well R-28 located in Mortandad Canyon. Chromium concentrations at that well are approximately 400 µg/L (ppb) exceeding the New Mexico Environment Department and Environmental Protection Agency standards of 50 µg/L and 100 µg/L, respectively. The Laboratory has prepared and is implementing an "Interim Measures Work Plan" pursuant to a requirement from the New Mexico Environment Department. Objectives of the Interim Measure Work Plan are to determine the primary source(s) of chromium contamination and the nature of operations associated with releases, characterize the present-day spatial distribution of chromium and related constituents, collect data to evaluate the geochemical and physical/hydrologic processes that govern chromium transport, and collect and evaluate data to help guide subsequent investigations and remedy selection.

Technical Area-54 Closure - This area includes evaluation and implementation of corrective measures for material disposal areas G, H, and L. The corrective measures are presumed to be the installation and monitoring of engineered covers and installation and operation of a soil vacuum extraction system at material disposal area L. This area also includes the demolition of the waste staging and characterization buildings at Areas L and G to facilitate the installation of the final covers. This work includes the closure of former and active radioactive waste disposal areas for Los Alamos National Laboratory.

Transuranic Waste - Transuranic waste stored in drums, standard waste boxes, and over-sized containers that equates to 44,000 drum equivalents stored both above and below ground the Los Alamos National Laboratory must be characterized, certified, and shipped in accordance with the Carlsbad Field Office procedures. Some of the waste requires repackaging to remove prohibited items or for size reduction of large items such as glove-boxes. Categories of waste include:

- Pit 9 Transuranic Waste - The Pit 9 transuranic waste retrieval project scope is to retrieve the transuranic waste stored in Pit 9 and place it in an inspectable storage configuration.

- Trenches A–D - Trenches A-D contain 363 casks containing two 30-gallon drums each. This project will include the retrieval of the casks from the trenches and placement of the waste in inspectable storage configuration.

- Remote Handled Transuranic Waste - The remote handled retrieval project scope is to retrieve and ship the transuranic waste and hot cells, perform site characterization to determine final disposition path, and place in an inspectable storage configuration (if required). This project also includes site stabilization and removal of any contaminated soils resulting from any breached containers.

Regulatory Framework

The primary regulatory driver for the Environmental Management Projects at Los Alamos National Laboratory is the March 1, 2005, Compliance Order on Consent. The Consent Order, signed by the New Mexico Environment Department, Los Alamos National Laboratory and DOE, provides the primary requirements for the Los Alamos National Laboratory Environmental Restoration Project, and establishes an enforceable schedule and milestones for corrective actions.

Other drivers include the 1995 Federal Facilities Compliance Agreement, Public Law 105–119, 10 Code of Federal Regulations, Part 830, Nuclear Safety Management, a hazardous waste facility permit for storage and treatment, Federal Facility Compliance Order, the Atomic Energy Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Toxic Substances Control Act, the Resource Conservation and Recovery Act, the Clean Air Act, and the Individual Permit issued by the U. S. Environmental Protection Agency in February 2009 for storm water management at Los Alamos National Laboratory.

Critical Site Uncertainties and Assumptions

New Mexico Environment Department could continue to increase scope for characterization activities, several additional Phases of characterization have already been imposed on the site in the last 3 years. Also NMED could select more costly remedies for the material disposal areas than assumed in baseline plans, potentially increasing cost and schedule for completion of some of these material disposal areas.

Monitored natural attenuation for groundwater will be accepted as the remedy rather than active remediation processes that can be more expensive and longer in duration.

Regulators will approve cleanup levels for individual sites that correspond to the intended land use, thereby leaving in place some contaminants that do not pose unacceptable health and environmental risks.

The condition of the waste stored below-grade will be no worse than that experienced in the previous transuranic waste inspectable storage retrieval project. Adverse conditions could have negative impacts on the cost and schedule.

Interdependencies

For disposition of legacy waste, Los Alamos National Laboratory is dependent on Government Furnished Services and Items and support from the Carlsbad Field Office in the area of characterization, packaging, and transportation of transuranic waste to the Waste Isolation Pilot Plant.

Contract Synopsis

A new contract was awarded in December 2005 to Los Alamos National Security, LLC, which assumed responsibility on June 1, 2006. This contract is a management and operating cost-reimbursable contract with performance-based provisions. Individual tasks are executed through management and operating issued procurements. Acquisition planning and execution for the Los Alamos National Laboratory Environmental Management Program is conducted by the management and operating contractor. The management and operating contractor awards subcontracts to provide significant flexibility to achieve cleanup in the most cost-effective manner.

Cleanup Benefits

The Environmental Management Projects at Los Alamos National Laboratory support the DOE's mission by addressing legacy waste, legacy waste sites, and groundwater protection consistent with the Consent Order. Regulatory closure of Los Alamos National Laboratory legacy waste sites and completion of the Los Alamos National Laboratory Environmental Restoration Projects support the DOE goal of cleanup at Los Alamos National Laboratory. Cleanup at Los Alamos reduces the DOE foot print, allows for the transfer to lands to the County and other property owners, reduces risk to the citizens of Los Alamos County, surrounding Pueblo lands, and protects groundwater and surface waters of the State.

Nevada Test Site

Site Overview

The Nevada Test Site was the primary location for conducting nuclear tests and was established to conduct tests of both nuclear and conventional explosives in connection with the research and development of nuclear weapons. Field testing was primarily conducted at the Nevada Test Site; however, some storage and transportation experiments were conducted on the Nevada Test and Training Range, formerly known as the Nellis Air Force Range. Atmospheric nuclear weapons tests were initiated in 1951. Portions of the Nevada Test Site and the Nevada Test and Training Range, including the Tonopah Test Range, were used for chemical explosion tests of plutonium- and uranium-bearing materials. Nuclear tests conducted at the Nevada Test Site after July 1962 was underground.

American Recovery and Reinvestment Act

The Nevada Test Site American Recovery and Reinvestment Act (ARRA) activities are funded at $44,325,000. Specifically, this funding will support the following activities: two ancillary structures will be demolished two new groundwater wells will be drilled in Pahute Mesa; four contaminated soil corrective action units (CAUs) (367, 374, 375, 106) will be characterized; and the RMAD and Pluto Facilities will be demolished. The Nevada Test Site will also maintain capability to dispose of low-level waste from approved generators throughout the DOE complex and mixed low-level waste as allowed under permit conditions as administered by the State of Nevada.

Site Description

The Nevada Test Site is located approximately 65 miles northwest of Las Vegas, Nevada and occupies approximately 1,375 square miles. The Nevada Test Site is surrounded by approximately 4,500 square miles of federally owned and Department of Defense-controlled land. The Nevada Test Site is surrounded by the Nevada Test and Training Range on the north, east, and west, and land managed by the U.S. Department of the Interior, Bureau of Land Management on the south and southwest. The Nevada Test and Training Range, which includes Tonopah Test Range, is used for military training. The Bureau of Land Management lands are used for grazing, mining, and recreation. The Nevada Test Site is in a remote and arid region with approximately 75 percent of its perimeter surrounded by Federal installations with strictly controlled access, and 25 percent adjacent to public lands that are open to public entry.

Site Cleanup Strategy/Scope of Cleanup

The EM program at the Nevada Test Site (including the Nevada Test and Training Range) consists of two primary projects: environmental restoration and waste management. The environmental restoration project scope is to assess and perform appropriate corrective actions at 879 former underground test locations, 113 surface or near-surface soil contamination locations, and more than 1,000 other industrial-type sites. The waste management project supports the completion of cleanup at DOE sites across the United States by maintaining the capability to dispose of low-level waste and mixed low-level waste.

The environmental restoration project scope addresses surface and shallow subsurface radiological soil contamination on the Nevada Test Site and Nevada Test and Training Range. Contamination at these sites is the result of historic nuclear detonations, safety experiments, storage- and transportation-related tests, nuclear reactor development and experiments, nuclear rocket engine tests, and hydronuclear experiments. The industrial-type site restorations address facility decontamination and decommissioning, various historical infrastructure remediation efforts (e.g., septic systems, mud pits, storage tanks, disposal sites, etc.), and conventional weapons cleanup including unexploded ordnance. The underground test area remediation involves geologic and hydrologic characterization, contaminated groundwater transport modeling, contaminant boundary definition and establishment of a monitoring system to protect against the inadvertent use of contaminated groundwater.

Site Completion (End State)

The long-term end state vision for the Nevada Test Site is to restore the environment to a level that will allow the continuation of the national security mission. This vision includes the removal of the contamination that poses an unacceptable risk to workers conducting planned site operations in support of the Nevada Site Office mission and characterizing and stabilizing the remainder of contamination to ensure effluent levels do not spread to the surrounding environment and pose an unacceptable risk to human health and the environment. The lifecycle planning estimate range for the end date of cleanup is 2027 to 2038.

Regulatory Framework

Nevada Site Office work at the Nevada Test Site and Nevada Test and Training Range follows all applicable federal level regulations including the Resource Conservation and Recovery Act, Clean Air Act, Clean Water Act, Atomic Energy Act, DOE Orders, and applicable Nevada specific laws, codes and acts relating to these regulations.

For the environmental restoration project, the primary regulatory process for addressing contaminants on the Nevada Test Site and surrounding areas (Nevada Test and Training Range) is the Federal Facility Agreement and Consent Order (1996).

For the waste management project, the primary regulatory process is the Federal Facility Compliance Act, which requires the Secretary of Energy to develop and submit Site Treatment Plans for the development of treatment capacity and technologies for treating mixed wastes.

Critical Site Uncertainties and Assumptions

The major assumptions are:

- Changes to the current Nevada Site Office regulatory framework, including consent agreements, state and federal regulations, and/or DOE orders will not impact the implementation of the Nevada Site Office EM baselines.
- There will not be a change in plans from limited to complete remediation (i.e., from "close in place" to "clean close") of contaminated soils areas on the Nevada Test Site or the Nevada Test and Training Range.

- Subsurface contamination in and around the underground nuclear test cavities will not be removed, and post-closure monitoring will be conducted as agreed upon in the site completion reports for the subsurface.

- After subsurface completion, the final long-term hydrologic monitoring program will be defined in the site completion reports for the subsurface.

- Current land-use designations and subsurface intrusion restrictions will continue into the foreseeable future.

Interdependencies

- The Nevada Site Office is dependent on concurrence from the U.S. Air Force on negotiated cleanup levels and plans to develop engineered controls and establish use restrictions.

- Nevada Site Office is dependent on the State of Nevada and other regulators for approval of investigation, characterization, closure, and long-term stewardship plans as stipulated in the Federal Facility Agreement and Consent Order.

- Nevada Site Office is dependent on the State of Nevada for acceptance of mixed low-level waste for disposal at the Nevada Test Site.

Contract Synopsis

There are two primary contractors working on EM activities at Nevada Site Office. The Management and Operating Contractor for the Nevada Test Site is contracted to perform environmental restoration field remediation activities and the waste management scope on the Nevada Test Site (including Nevada Test and Training Range). The Environmental Characterization and Remediation Services Contractor is contracted to perform site investigation and characterization activities on the Nevada Test Site (including Nevada Test and Training Range).

Cleanup Benefits

The near- and long-term benefits for Nevada Site Office environmental restoration efforts include the overall reduction to potential human health and environmental risks, and restoration of the environment to a level that will allow the effective continuation of the national security mission conducted by the Nevada Site Office.

The near-term and long-term benefit for maintaining sufficient low-level and mixed low-level radioactive waste disposal capabilities is to support accelerated cleanup across the DOE complex. Disposing of radioactive waste from storage locations across the DOE complex in engineered disposal facilities at the Nevada Test Site will substantially reduce health and environmental risks at other DOE sites.

Pantex

Site Overview

Pantex has a continuing mission to support nuclear weapons activities for the Nation's stockpile. The primary missions of the Pantex Plant are to: 1) evaluate, retrofit, and repair nuclear weapons in support of life extension programs and certification of weapon safety and reliability programs; 2) dismantle nuclear weapons surplus to the stockpile; 3) sanitize components from dismantled weapons; 4) develop, test, and fabricate chemical and explosive components; and 5) provide interim storage and surveillance of the plutonium components.

Historical waste management practices at the Pantex Plant have resulted in contamination of soils and the upper Perched Aquifer. High explosives, metals, and solvents exist in soils located at the Pantex Plant. The Perched Aquifer contaminant plume has migrated past the Plant boundaries and onto adjacent landowners' properties to the southeast that EM recently purchased to achieve remedial action objectives required by the Record of Decision with Environmental Protection Agency, Region 6.

Site Description

The Pantex Plant is located in the Texas Panhandle, approximately 17 miles northeast of Amarillo, Texas. Pantex was deactivated in 1945 and sold to Texas Technical University as excess government property. In 1951 the Atomic Energy Commission reclaimed approximately 10,000 acres for the manufacturing of high explosives for the nuclear weapons program.

Site Cleanup Strategy/Scope of Cleanup

The legacy environmental cleanup mission at Pantex is complete.

Site Completion (End State)

The legacy environmental cleanup mission at Pantex was completed in FY 2009. The site will remain an active industrial site with 15 of 252 potential release sites remaining in operation. Decontamination and decommissioning activities, completed waste and debris removal completed in FY 2009.

Regulatory Framework

The environmental work is identified and conducted under the requirements of regulatory framework and agreements with Environmental Protection Agency, and the Texas Commission on Environmental Quality.

Critical Site Uncertainties and Assumptions

The legacy environmental cleanup mission at Pantex is complete. It is assumed that no additional actions will be required in the near term to address legacy contamination and that no active sites will be added to the Pantex scope.

Contract Synopsis

The Pantex Plant is operated by Babcock and Wilcox Technical Services Pantex, LLC under a cost-plus-award-fee Management and Operating contract.

Cleanup Benefits

Near Term Benefits: Enhanced onsite worker safety through source reduction efforts and site remediation. Protection of the Ogallala aquifer from cross contamination through the perched aquifer by implementing interim corrective measures such as a pump and treatment system, soil vapor extraction, in-situ bioremediation, and Playa 1 dewatering.

Sandia National Laboratories-New Mexico

Site Overview

The Sandia National Laboratories-New Mexico site is located in Albuquerque, New Mexico. The Sandia National Laboratories Environmental Restoration Project scope includes the remediation of inactive waste disposal and release sites at Albuquerque and other off-site locations. These sites have known or suspected releases of hazardous, radioactive, or mixed waste.

Site Description

The Sandia National Laboratories-New Mexico site is a multi-program national laboratory with research and development programs in a broad range of scientific and technical fields. It is located in Bernalillo County, New Mexico, 6.5 miles east of downtown Albuquerque. Sandia National Laboratories consists of five technical areas and several remote areas covering 2,820 acres in the eastern half of the 118 square miles of Kirtland Air Force Base. The base is situated on two broad mesas bisected by the Tijeras Arroyo and is bound by the Manzano Mountains to the east and the Rio Grande river to the west.

Site Cleanup Strategy/Scope of Cleanup

Environmental restoration at Sandia National Laboratories was initiated to assess and remediate 265 soil contaminated areas following federal, state and local statutes, as well as three groundwater areas. Three soil sites will remain as "deferred active mission sites" and require future remediation (future liability).

Site Completion (End State)

The actual risk level of the site and the expected future land use will be used to determine the end-state for all soil areas being cleaned up. The end-state will be reached when: 1) all of the solid waste management units and the groundwater areas of concern are remediated or remediation systems are constructed and operational, and all waste disposed of; and 2) the site is placed under institutional controls with long-term monitoring in accordance with State and Federal requirements.

Regulatory Framework

The regulatory driver for completing this work is the April 2004 New Mexico Environment Department Compliance Order on Consent.

Critical Site Uncertainties and Assumptions

There are two critical project uncertainties based primarily on the New Mexico Environment Department's regulatory approval not being in place. First, the work schedule is jeopardized and the risk of added cleanup scope exists due to the regulatory uncertainty. Second, the requirement for additional public review of closure documents could delay completion. Regulatory uncertainty on three groundwater areas will exist until the final remedy that aligns with the exit strategy is received.

Interdependencies

The National Nuclear Security Administration assumed long-term stewardship responsibilities in FY 2007 for the completed 263 soil sites.

Contract Synopsis

The current management and operating contract between DOE and Sandia National Laboratories will exist for the remainder of the Environmental Management Project. Sandia National Laboratories will also keep several sub-contracts active beyond FY 2009 to assist with the completion of administrative regulatory closure requirements.

Cleanup Benefits

At the end of FY 2009, 265 of 268 soil release sites were completed. Three groundwater areas of concern for this project, however, are yet to be completed; these groundwater areas are currently in various stages of characterization.

Separations Process Research Unit

Site Overview

The Separations Process Research Unit is an inactive pilot plant used to research and develop the chemical process to separate plutonium from radioactive material. The Separations Process Research Unit operated from 1950 to 1953. Operation of the Separations Process Research Unit contaminated the nuclear facilities and impacted approximately thirty acres of land where waste containers were managed. Groundwater immediately adjacent to the nuclear facilities and in a limited area where containers were once stored, is also contaminated with radioactivity.

American Recovery and Reinvestment Activities

The Separations Process Research Unit American Recovery and Reinvestment Act (ARRA) activities are funded at $51,775,000. Specifically, this funding will be used to remove radioactively-contaminated soils from the 15-acre North Field Area, a part of the Separations Process Research Unit Disposition Project, located at the Knolls Atomic Power Laboratory resulting in removal of 6,000 cubic yards of soil. Confirmation sampling will take place and the area will be restored as appropriate and two Separations Process Research Unit nuclear facilities (Buildings G2 and H2) at the Knolls Atomic Power Laboratory, will be decontaminated and decommissioned totaling approximately 50,000 square feet.

Site Description

The Separations Process Research Unit is located within the 170-acre Knolls Atomic Power Laboratory near Schenectady, New York, which is currently operated by the NNSA Naval Reactors Program. The Mohawk River forms the northern boundary of this site. In addition, industrial and residential areas also bound the site.

Site Cleanup Strategy/Scope of Cleanup

The proposed cleanup strategy for the project is to remove the nuclear facilities and remediate the land areas. This approach is consistent with DOE Environmental Management's strategic objectives to eliminate legacy facilities, stabilize and consolidate transuranic waste at the Waste Isolation Pilot Plant, meet site Resource Conservation and Recovery Act Permit investigation and cleanup requirements, eliminate surveillance and maintenance costs of the nuclear facilities, and allow DOE Environmental Management (EM) to close out an agreement with Naval Reactors for the disposition of the Separations Process Research Unit facilities. Upon completion of the Separations Process Research Unit project, the land will be transferred back to the Naval Reactors Program for their continuing mission use.

Site Completion (End State)

Taking into account Naval Reactors' continuing use of this site, and the fact that work with radioactive materials continues, the appropriate DOE Environmental Management end state for this site is to remove the contaminated excess facilities and restore land areas for continued industrial use. The cleanup work is scheduled to end in FY 2011.

Regulatory Framework

The Separations Process Research Unit project scope includes decommissioning and removal of facilities and cleanup activities using DOE's non-time critical removal action authority under the Comprehensive Environmental Response, Compensation, and Liability Act. In addition, the Separations Process Research Unit project has received a Resource Conservation and Recovery Act corrective action-only permit from New York State for investigation and cleanup of residual chemicals in several solid waste management units contained within the project areas.

Critical Site Uncertainties and Assumptions

Project risks currently being managed by the DOE Separations Process Research Unit Field Office and its contractors include the potential for unanticipated amounts of contaminated soil being encountered in the Separations Process Research Unit land areas, the potential for larger than anticipated labor needs for the removal of nuclear facilities, and the potential for encountering unforeseen types of contamination in the nuclear facilities.

Interdependencies

The major interdependency related to the Separations Process Research Unit is the ongoing relationship with Naval Reactors and Knolls Atomic Power Laboratory, as formally documented in a Memorandum of Agreement. Other interdependencies are associated with waste disposition and will include the Waste Isolation Pilot Plant, as well as other waste disposal sites selected by the Separations Process Research Unit contractors. The project will work with these sites to ensure the expeditious transportation of waste and compliance with site waste acceptance criteria.

Contract Synopsis

All contracts awarded since FY 2006 are administered by EM's Consolidated Business Center. A small business contractor was used to accelerate removal of small structures and improve small business involvement with the Separations Process Research Unit Project.

The Separations Process Research Unit Project is also making use of an existing EM Indefinite Delivery/Indefinite Quantity contract in support of both the land environmental restoration and building decontamination and decommissioning. Task orders have been awarded and field work began for both task orders during FY 2009.

Cleanup Benefits

The benefits of completing the Separations Process Research Unit Project are removal of a legacy Cold War project site, consolidation of transuranic waste at the Waste Isolation Pilot Plant, elimination of surveillance and maintenance costs of inactive nuclear facilities, and reutilization of land areas formerly occupied by the Separations Process Research Unit Project by the Naval Reactors Program.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
NNSA Sites			
VL-FOO-0013B-D / Solid Waste Stabilization and Disposition Support - Lawrence Livermore National Laboratory (Defense)	0	238	238
VL-NV-0100 / Nevada Community and Regulatory Support	4,169	2,556	2,562
VL-NV-0030 / Soil and Water Remediation-Nevada Test Site	58,657	58,794	53,840
VL-NV-0080 / Operate Waste Disposal Facility-Nevada	12,848	4,324	9,598
VL-FAO-0101 / Miscellaneous Programs and Agreements in Principle	1,443	2,938	3,047
VL-SPRU-0040 / Nuclear Facility D&D-Separations Process Research Unit	18,000	15,000	12,500
VL-LLNL-0031 / Soil and Water Remediation-Lawrence Livermore National Laboratory - Site 300	688	910	635
VL-LANL-0013 / Solid Waste Stabilization and Disposition-LANL Legacy	100,790	74,523	75,353
VL-LANL-0030 / Soil and Water Remediation-LANL	116,269	121,977	121,600
VL-LANL-0040-D / Nuclear Facility D&D-LANL (Defense)	5,675	0	0
VL-PX-0030 / Soil and Water Remediation-Pantex	1,000	0	0
VL-SN-0030 / Soil and Water Remediation-Sandia	3,000	2,864	0
Subtotal, NNSA Sites	322,539	284,124	279,373
Total, Defense Environmental Cleanup	322,539	284,124	279,373
Non-Defense Environmental Cleanup			
Small Sites			
VL-LANL-0040-N / Nuclear Facility D&D-LANL (Non-Defense)	1,905	0	0
Subtotal, Small Sites	1,905	0	0
Total, Non-Defense Environmental Cleanup	1,905	0	0
Total, NNSA Sites	324,444	284,124	279,373

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
NNSA Sites					
Geographic Sites Eliminated (number of sites)	7	7	7	12	58.3%
Industrial Facility Completions (Number of Facilities)	4	4	4	4	100.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	11,393	11,618	12,895	14,332	90.0%
Nuclear Facility Completions (Number of Facilities)	0	0	1	4	25.0%

Radioactive Facility Completions (Number of Facilities)	1	1	2	106	1.9%
Remediation Complete (Number of Release Sites)	3,432	3,468	3,564	5,078	70.2%
Transuranic Waste shipped for disposal (Cubic meters) - CH	3,721	4,680	7,893	14,287	55.3%
Transuranic Waste shipped for disposal (Cubic meters) - RH	16	16	16	94	17.0%

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
VL-FOO-0013B-D / Solid Waste Stabilization and Disposition Support - Lawrence Livermore National Laboratory (Defense)	**0**	**238**	**238**

This PBS can be found within the Defense Environmental Cleanup appropriation.

Cleanup activities at Site 300 will be completed in FY 2014. Activities performed in this project will continue to provide funding for:

- Grants to the State of California Regional Water Quality Control Board and the California Department of Toxic Substances Control to provide oversight. This funding is mandated by the Federal Facility Agreement signed by DOE, Environmental Protection Agency, and the State of California.
- Support for site investigations, hydrogeologic studies, regulatory review, and stakeholder liaisons are also managed within this project through wide applicability of these restoration activities. This project will end when all environmental restoration activities are completed at Site 300.

In FY 2011, the following activities are planned.

- Maintain regulatory interactions in support of Building 812 Firing Table cleanup.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

VL-LLNL-0031 / Soil and Water Remediation-Lawrence Livermore National Laboratory - Site 300	**688**	**910**	**635**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The remedial actions required by regulatory decision documents will reduce the risks, overall liability, and mortgage at Site 300 associated with 37 distinct groundwater plumes contaminated with volatile organic compounds, high explosives, nitrate, perchlorate, tritium, and/or depleted uranium. Build-out of the required

(dollars in thousands)

FY 2009	FY 2010	FY 2011

remediation network system will address risk reduction associated with groundwater contamination and will complete the project.

The Operable Unit 9 Building 812 Firing Table will remain the responsibility of EM until FY 2014 when soil remediation in the area is expected to be complete.

In FY 2011, the following activities are planned.

- Complete remedial investigation/feasibility study for Building 812.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	74	74	74	74	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Construct, install, and operate the GW extraction and treatment system in the Pit 7 Complex. (FY 2009)
- Removed contaminated surface soil and sand pile at Building 850. (FY 2009)
- Complete Building 812 Firing Table Proposed Plan (September 2011)

VL-LANL-0013 / Solid Waste Stabilization and Disposition-LANL Legacy **100,790** **74,523** **75,353**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The Solid Waste Stabilization and Disposition Project (PBS-VL-LANL-0013), also known as the Legacy Waste Disposition Project, is comprised of the treatment, storage, and disposal of legacy transuranic and mixed low-level waste generated between 1970 and 1999 at the Los Alamos National Laboratory. The end-state of this project is the safe disposal of legacy waste from Los Alamos National Laboratory.

This project scope is integrated with the Soil and Water Remediation Project (PBS-VL-LANL-0030) which includes compliance activities associated with the New Mexico Environment Department 2005 Compliance Order on Consent. The other driver requiring disposition of this waste is the Site Treatment Plan developed under the authority of the 1995 Federal Facility Compliance Agreement between the National Nuclear Security Administration and the Environmental Protection Agency. The Solid Waste Stabilization and Disposition Project includes disposition of legacy and generated, mixed, low-level waste and is scheduled to be completed by FY 2015. Transuranic Waste Operations continue under Carlsbad Field Office's Central Characterization Project and the Los Alamos National Laboratory for contact- and remote-handled transuranic waste retrieval and disposition.

In FY 2011, the following activities are planned:

- Continue characterization and certification of transuranic waste for shipment to the Waste Isolation Pilot Plant.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Continue transuranic drum remediation capacity to support up to three shipments a week to the Waste Isolation Pilot Plant.
- Package 2,000 containers of High Activity Transuranic Waste for disposition.
- Disposition 300 cubic meters of low-level waste.
- Install and start-up the Nuclear Filter Technology Drum Venting System.
- Continue disposal of low- level waste and pursue offsite disposal for majority of operational and environmental restoration/decontamination and decommissioning generated waste.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	2,350	3,309	6,472	12,866	50.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	16	16	16	94	17.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,882	2,107	3,384	4,821	70.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Decrease legacy transuranic waste by 1,400 cubic meters (FY 2009)
- Complete 1st 16 Remote-Handled Canisters Shipment. (FY 2009)
- Hot Cell Liner Start (Safety Basis) (April 2010)
- CMP Begin Retrieval Operations (April 2011)
- Begin Retrieval Operations for Trenches A-D (July 2011)

VL-LANL-0030 / Soil and Water Remediation-LANL 116,269 121,977 121,600

This PBS can be found within the Defense Environmental Cleanup appropriation.

The Los Alamos National Laboratory Soil and Water Remediation Project scope includes identification, investigation and remediation of chemical and or radiological contamination attributable to past Laboratory operations and practices. The remaining scope of the project includes characterization, monitoring, and protection of the surface and groundwater at the Laboratory and approximately 860 Potential Release Sites left to be investigated, remediated or closed by evaluation and assessment of human health and ecological risks. Included in the scope for the 860 sites remaining to be addressed are: 1) characterization and final remedy of eight priority material disposal areas which are to follow the Resource Conservation and Recovery Act corrective measures study and implementation process. One of the material disposal areas, at Technical Area-54, is the former and active radioactive waste disposal area for the Laboratory; 2) protection and monitoring of groundwater resources to ensure protection of drinking water supplies; 3) remediation of Technical Area-21, including 3 material disposal areas and over 100 Solid Waste Management Units.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011, the following activities are planned:

- Completion of Phase II Investigation and submittal of the Phase II Report for Middle Los Alamos Canyon Aggregate Area.
- Completion of characterization activities for Upper Cañada del Buey, Two Mile, and Canyon de Valle Aggregate Areas; Completion of an additional twelve field campaigns; Completion of Investigation Reports for Upper Cañada del Buey, Two Mile, and Canyon de Valle Aggregate Areas; Completion of Investigation and Accelerated Clean-up Work Plans for Pajarito/Three Mile and Two Mile Aggregate Areas; Completion of Corrective Measures Evaluation Plans for Firing Site R-44, MDA AB, and MDA C.
- Completion of the Analytical Report for the General's Tanks; Completion of the Radiological Risk Assessment Report for the General's Tanks; Initiation of the Treatability Study for the General's Tanks; Completion of the Vapor Intrusion Assessment Report for MDA T; Completion of the Corrective Measures Evaluation Report for MDA T; Completion of the Corrective Measures Implementation design for MDA T; Completion of the Vapor Monitoring Reports for MDA V; Completion of the Clean-up and Characterization of SWMU 21-022(b)-99, Industrial Waste Lines
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	5,426	5,426	5,426	5,426	100.0%
Remediation Complete (Number of Release Sites)	1,426	1,456	1,548	2,089	74.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete construction of the material disposal area (MDA) H landfill cap (FY 2009)
- Complete final engineered cover for Material Disposition Area H (Technical Area-54). (FY 2009)
- Complete construction of 260 Outfall Corrective Measures for alluvial/surface water treatment system. (FY 2009)
- Complete investigation and report for Upper Sandia Canyon Aggregate Area (May 2010)
- S-Site Aggregate Area Investigation Report (August 2010)
- Upper Canada del Buey Aggregate Area Investigation Report (November 2010)
- Complete Material Disposition Area T vapor intrusion assessment report (December 2010)
- Los Alamos National Laboratory Material Disposition Area B EMRAP - Remedy Completion Report for SWMU 21-015 (MDA B) (December 2010)
- Complete Material Disposition Are T CME report (January 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Complete phase 2 investigation and report for Middle Los Alamos Canyon Aggregate Area (March 2011)
- Complete and submit CME Plans for Firing Site R-44 (May 2011)
- Complete and submit CME Plans for Material Disposition Area C (May 2011)
- Annual Update of the Interim Facility-Wide Groundwater Monitoring Plan (2011) (May 2011)
- Complete cleanup and cleanup report for Three Mile Aggregate Area (May 2011)
- Complete cleanup and cleanup report of Two Mile Aggregate Area (July 2011)
- Two Mile Aggregate Area Investigation Report (July 2011)
- Complete and submit CME Plans for Material Disposition Area AB (August 2011)
- Individual Permit Reporting and Compliance (Annual Report) (September 2011)

	FY 2009	FY 2010	FY 2011
VL-LANL-0040-D / Nuclear Facility D&D-LANL (Defense)	**5,675**	**0**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

There are several facilities excess to the DOE mission at the Los Alamos National Laboratory, including structures at Technical Area-21 and Technical Area-54 that require decommissioning and decontamination, in order to complete the EM mission at the Los Alamos National Laboratory and to maintain compliance with the New Mexico Environment Department Consent Order and the Order.

In FY 2011, the following activities are planned:

- No activities are planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Radioactive Facility Completions (Number of Facilities)	0	0	0	99	0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete D&D of DP West (FY 2009)
- Start D&D Field Work at DP West (October 2009)
- Remedy Completion Report for MDA L (July 2011)

	FY 2009	FY 2010	FY 2011
VL-LANL-0040-N / Nuclear Facility D&D-LANL (Non-Defense)	**1,905**	**0**	**0**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

The Tritium System Test Assembly Facility was transferred into the EM Program in FY 2003 for continued surveillance and maintenance, limited deactivation, and eventual demolition.

In FY 2011, the following activities are planned:

- No planned activities in FY 2011; the scope of work typically covered in this Program Baseline Summary is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Radioactive Facility Completions (Number of Facilities)	0	0	1	6	17.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue surveillance and maintenance activities at the Tritium Systems Test Assembly (FY 2009)
- Start demolition of the Tritium Systems Test Assembly (October 2009)

	FY 2009	FY 2010	FY 2011
VL-NV-0030 / Soil and Water Remediation-Nevada Test Site	**58,657**	**58,794**	**53,840**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The overall objective of this project is to provide for appropriate risk-based remediation of surface and subsurface contamination of industrial and soil contaminated sites. The cleanup is complex due to the number of sites, nature/extent of contamination, and site size/location. The surface contamination includes over 1,000 industrial-type sites and approximately 100 soil contamination sites on the Nevada Test Site and Nevada Test and Training Range. The subsurface contamination includes approximately 900 groundwater contamination sites on the Nevada Test Site. The industrial-type release sites are mainly support facilities and structures that were left after conducting aboveground and underground nuclear tests, surface nuclear engine and reactor experiments, and weapons delivery systems.

Currently, activities at approximately 1,000 industrial-type sites have been completed, and activities at approximately 1,000 other sites are in progress.

In FY 2011, the following activities are planned:

- Complete closure of one contaminated waste site and decontamination and decommissioning of one facility (Test Cell C).
- Continue decontamination and decommissioning activities at the Engine Maintenance, Assembly, and Disassembly Facility.
- Continue progress toward closure of 878 subsurface contaminated release sites on the Nevada Test Site.

- Complete the Frenchman Flat Phase II corrective action decision document and corrective action plan.
- Complete Rainier Mesa Phase I source term report.
- Complete Rainier Mesa Phase I contaminant boundary flow and transport model analysis and evaluation.
- Drill two data acquisition wells in Pahute Mesa.
- Complete two Pahute Mesa Phase II well development testing and sampling operations, and complete three well analyses.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	1,060	1,061	1,064	2,036	52.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submit Corrective Action Unit 130 Closure Report (CR) (FY 2009)
- Submit Corrective Action Unit 117 Closure Report (FY 2009)
- Submit Corrective Action Unit 166 Closure Report (FY 2009)
- Continue underground test area analysis, evaluation, and monitoring network activities on the Nevada Test Site (September 2010/September 2011)
- Complete assessment and closure activities for industrial-type sites on the Nevada Test Site and the Tonopah Test Range (September 2010)
- Complete Assessment and Closure Activities for Contaminated Waste Sites on the Nevada Test Site and the Tonopah Test Range (September 2011)

VL-NV-0080 / Operate Waste Disposal Facility-Nevada 12,848 4,324 9,598

This PBS can be found within the Defense Environmental Cleanup appropriation.

This Project provides low-level waste and mixed low-level waste disposal capability to meet the needs of all DOE sites through FY 2027. The amount of funding requested within this Program Baseline Summary depends on waste forecasts from DOE programs. Continuing the practice begun in FY 2009, non-EM programs will fund a share of this PBS based upon each program's share of the waste disposed at the Nevada Test Site. Nevada maintains the capability to dispose low-level waste and mixed low-level waste (as allowed under permit conditions as administered by the State of Nevada), and disposal of classified matter from approved generators throughout the DOE complex. Discussions with the State are ongoing regarding the planning and permitting for a new mixed low-level waste disposal cell which could be operational at the end of FY 2011. The total Nevada Test Site low-level waste, mixed low-level waste, and classified matter life-cycle volume from complex-wide generators is projected to be over 1.275 million cubic meters.

In FY 2011, the following activities are planned:

- Support cleanup activities across the DOE complex by disposing of approximately 39,500 cubic meters of low-level and mixed low-level radioactive waste. Of that total, 52 percent is estimated to be generated by ARRA-funded cleanup programs and 10 percent of the total estimated disposal will be mixed low-level waste.

- Continue audits and waste certification reviews in support of generator programs to ensure compliance with the Nevada Test Site Waste Acceptance Criteria.

- Continue developing and maintaining plans, permits, safety basis, and technical and regulatory support for activities such as the Nevada Test Site Resource Conservation and Recovery Act Part B Permit, Mutual Consent Agreement, Site Treatment Plan, and Consent Orders.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Dispose low-level waste and mixed low-level waste (FY 2009)
- Dispose low-level waste in support of the DOE Complex; conduct audits; maintain technical/safety documentation (September 2010)
- Dispose low-level waste in Support of DOE Complex; Conduct Audits; Maintain Technical/Safety Documentation (September 2011)

	FY 2009	FY 2010	FY 2011
VL-NV-0100 / Nevada Community and Regulatory Support	**4,169**	**2,556**	**2,562**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS provides support for Agreements in Principle with three state agencies including the Nevada Division of Emergency Management, the Nevada Division of Environmental Protection, and the Nevada Department of Human Resources. This PBS also includes funding for the annual Federal Facilities Agreement and Consent Order fee and a grant with the University of Nevada, Las Vegas.

In FY 2011, the following activities are planned:

- Provide support for State of Nevada regulatory oversight of the Nevada Test Site, for Community Advisory Board activities, and for the agreements and grants with organizations in the State of Nevada.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Provide Regulator and Stakeholder Funding (FY 2009/September 2010/ September 2011)					

VL-FAO-0101 / Miscellaneous Programs and Agreements in Principle	**1,443**	**2,938**	**3,047**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The New Mexico Agreement in Principle reflects the understanding and the commitments between the parties regarding DOE's provision to New Mexico of additional technical and financial support for State activities in environmental oversight, and monitoring to provide independent verification of DOE's compliance with applicable federal, state and local laws, including rules, regulations, and standards at Los Alamos National Laboratory.

In FY 2011, the following activities are planned:

- Support the New Mexico Agreement in Principle.
- Support the Natural Resource Damage Assessment at Los Alamos National Laboratory.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ New Mexico fulfills Agreement-in-Principle (FY 2009)					

VL-SPRU-0040 / Nuclear Facility D&D-Separations Process Research Unit	**18,000**	**15,000**	**12,500**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The project objectives are to remove the inactive nuclear facilities and disposition the chemical and radioactive contamination in land areas and return the areas back the Knolls Atomic Power Laboratory for continued mission use by the Naval Reactors Program.

In FY 2011, the following activities are planned:

- Complete the North Field contaminated soil cleanup (15 acres remediated).
- Complete removal of tanks and tanks waste from building H2 vaults.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Complete shipments of all transuranic and other waste from the Site.
- A portion of the scope of work typically covered in this Program Baseline Summary is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	50	50	100.0%
Nuclear Facility Completions (Number of Facilities)	0	0	1	4	25.0%
Remediation Complete (Number of Release Sites)	0	4	5	6	83.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Conduct surveillance and maintenance to allow the facilities (FY 2009)
- Tank waste and other process residuals will be consolidated and packaged for shipment. (September 2010)
- Clean-up 4 Resource Conservation and Recovery Act Solid Waste Management Units in the Lower Level Rail Bed (September 2010)
- Complete Soil Removal for Lower Level (September 2010)
- Complete Shipment of transuranic waste (September 2011)
- Complete Soil Removal (September 2011)

VL-PX-0030 / Soil and Water Remediation-Pantex **1,000** **0** **0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

As of the end of FY 2008, joint approval by the Environmental Protection Agency and the Texas Commission on Environmental Quality result in closure of 237 release sites, with an additional 15 active release sites remaining in operation after project completion in FY 2009.

In FY 2011, no activities are planned:

- Project complete.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	237	237	237	237	100.0%

VL-SN-0030 / Soil and Water Remediation-Sandia **3,000** **2,864** **0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

In FY 2011, the following activities are planned.

- No activities are planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Radioactive Facility Completions (Number of Facilities)	1	1	1	1	100.0%
Remediation Complete (Number of Release Sites)	263	264	264	264	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Submit Notice of Disapproval (NOD) Response on Tijeras Arroyo Groundwater Investigation Report (FY 2009)
- Submit NOD Response on Tech Area-V GW on CME Report (FY 2009)
- Start Mixed Waste Landfill Cover Installation (FY 2009)
- Start Public Hearing on Chemical Waste Landfill (FY 2009)
- Submit Final CMI (Resource Conservation and Recovery Act) Report to the New Mexico Environment Department for Chemical Waste Landfill (March 2010)
- Submit Corrective Measure Implementation (CMI) Report for the Mixed Waste Landfill (MWL) to the New Mexico Environment Department. (March 2010)
- Complete characterization on 4 new Mixed Waste Landfill Groundwater Wells (May 2010)

	FY 2009	FY 2010	FY 2011
Total, NNSA Sites	**324,444**	**284,124**	**279,373**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
NNSA Sites	
Lawrence Livermore National Laboratory	
VL-LLNL-0031 / Soil and Water Remediation-Lawrence Livermore National Laboratory - Site 300	
▪ Decrease attributable to the completion of the bench scale treatability study for cleanup of the Building 812 Firing Table.	-275
Los Alamos National Laboratory	
VL-LANL-0013 / Solid Waste Stabilization and Disposition-LANL Legacy	
▪ The increase is attributable to additional mixed low-level waste shipments of transuranic waste to the Waste Isolation Pilot Plant for disposal.	830
VL-LANL-0030 / Soil and Water Remediation-LANL	
▪ Decrease reflects the base program scope of the Material Disposal Area B cleanup and monitoring wells activities that is now being funded by ARRA.	-377
Nevada	
VL-NV-0030 / Soil and Water Remediation-Nevada Test Site	
▪ Decrease is due to the completion of release sites associated with buried waste, the completion of monitoring network design.	-4,954
VL-NV-0080 / Operate Waste Disposal Facility-Nevada	
▪ The increase is for the share of disposal costs direct-funded by EM. The balance of funds for base disposal operations will be obtained through transfer of funding from other DOE mission programs generating waste and potential other sources.	5,274
VL-NV-0100 / Nevada Community and Regulatory Support	
▪ No significant change.	6
NNSA Service Center/Separations Processing Research Unit (SPRU)	
VL-FAO-0101 / Miscellaneous Programs and Agreements in Principle	
▪ No significant change.	109
VL-SPRU-0040 / Nuclear Facility D&D-Separations Process Research Unit	
▪ Decrease reflects the acceleration of the North Field land Remediation and completion of demolition of nuclear facility Buildings G2 and H2 to facilitate return of land to Naval Reactors for future use.	-2,500
Sandia National Laboratories	
VL-SN-0030 / Soil and Water Remediation-Sandia	

	FY 2011 vs. FY 2010 ($000)
- The decrease is attributable to the planned work-scope being completed.	-2,864
Total, NNSA Sites	**-4,751**

West Valley Demonstration Project

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
West Valley Demonstration Project	65,500	73,875	58,074	58,074
Total, West Valley Demonstration Project	65,500	73,875	58,074	58,074

Site Overview

The West Valley Demonstration Project is being executed at the site of the only commercial nuclear fuel reprocessing facility to have operated in the United States. The West Valley Demonstration Project is located on the site of the Western New York Nuclear Service Center, of which title is held by the New York State Energy Research and Development Authority. The principal mission of DOE is to satisfy the mandates established by the West Valley Demonstration Project Act of 1980 (Public Law 96-368):

- Solidify, in a form suitable for transportation and disposal, the high-level waste;
- Develop containers suitable for permanent disposal of the solidified high-level waste;
- Transport, in accordance with applicable law, the solidified waste to an appropriate disposal site;
- Dispose of low-level waste and transuranic waste produced by high-level waste solidification activities;
- Decontaminate and decommission tanks and facilities used for solidification of high-level waste, as well as any material and hardware used in connection with the Project, in accordance with Nuclear Regulatory Commission requirements.

American Recovery and Reinvestment Act Activities

The West Valley American Recovery and Reinvestment Act (ARRA) activities are funded at $73,875,000. Specifically, this funding will be used to begin work on demolition of former process buildings and installation of a system to prevent migration of groundwater contamination. Radioactive waste treatment and disposal activities will also be accelerated to shrink the area of site contamination. American Recovery and Reinvestment Act funds at West Valley will be used to process approximately 1,500 cubic feet of contact-handled transuranic waste, low-level and mixed low-level wastes for off-site disposal.

- Installation of a Tank and Vault Drying System to support reducing risk of liquid releases associated with high-level waste tank heels presently contained in tank bottoms. This work supports the

Environmental Impact Statement Record of Decision to safely manage the tanks in the near-term (up to 30 years) and defer final decision making. It is anticipated that regardless of which final closure option is selected (options include - tank exhumation or closing in place), the Tank and Vault Drying System will be decommissioned and removed.

- Removal of approximately 18,000 gallons of liquids from the Main Plant Process Building to support decontamination and eventual demolition.
- Implementation of mitigation measures for managing the North Plateau Groundwater Plume by installing a permeable treatment wall at the site premises fence line.
- Completion of demolition of the 01-14 building containing sodium bearing waste process equipment.

Site Description

The West Valley Demonstration Project is located approximately 40 miles south of Buffalo, New York. DOE has operational responsibility for approximately 165 acres located near the center of the larger 3,345 acre Western New York Nuclear Service Center, which is owned by the State of New York.

Site Cleanup Strategy/Scope of Cleanup

DOE has completed the first two mandates of the West Valley Demonstration Project Act – solidification of the liquid high-level waste and development of containers suitable for permanent disposal of the high-level waste. There are currently 275 high-level waste canisters that have been produced that are in safe storage within the former spent fuel reprocessing plant. The remaining work to be completed by DOE at West Valley includes (1) shipment of the high-level waste canisters for off-site disposal; (2) disposal of Project-generated low-level waste and transuranic waste; and (3) facility decontamination and decommissioning. Additionally, in accordance with the DOE and New York State Energy Research and Development Authority spent fuel agreement, DOE shipped 125 spent fuel assemblies to the Idaho National Environmental and Engineering Laboratory in July 2003.

The technical, schedule and cost considerations associated with decommissioning of the West Valley Demonstration Project are being considered during development of the Decommissioning and/or Long Term Management Environmental Impact Statement. A Record of Decision is planned for issuance in March 2010. As such, DOE will focus its near-term efforts on waste disposition, process building decontamination and removal of non-essential facilities that can precede in the near-term while the Decommissioning Environmental Impact Statement is completed.

Site Completion (End State)

Until DOE completes its evaluation and analysis of various closure alternatives in the Decommissioning Environmental Impact Statement and issues a Decommissioning Record of Decision, DOE plans to proceed toward Interim End State completion in FY 2011. DOE anticipates that this acceleration can be achieved through the influx of American Recovery and Reinvestment Act funds. The West Valley Demonstration Project Interim End State is defined as:

- Shipment of all low-level waste and transuranic waste generated by DOE as a result of the high-level waste solidification project;

- Deactivation, demolition, and removal of all DOE-managed facilities (foundations remain), with the exception of: 1) former spent nuclear fuel reprocessing facility (Main Plant Process Building) and any other support facilities required for the interim storage of the high-level waste canisters; 2) the Remote-Handled Waste Processing Facility; 3) the Vitrification Facility; and 4) the Waste Tank Farm.
- Removal of major components and decontamination of the Main Plant Process Building;
- Configuring utilities and infrastructure to achieve cost effective long-term storage and maintenance of the Main Plant Process Building and other facilities including the Waste Tank Farm, until off-site transport of the high-level waste canisters can be facilitated;
- Initiate activities to support construction of a Dry Storage Facility for the High Level Waste canisters and removal of the High Level Waste canisters from the Main Plant Process Building.
- Install Permeable Treatment Wall to mitigate North Plateau Sr-90 Plume Expansion

The Decommissioning, and/or Long Term Stewardship Environmental Impact Statement Record of Decision, currently planned in March 2010, will establish long-term activities required to achieve final site end state. DOE will proceed with the actions consistent with the Record of Decision. The Record of Decision will address the following actions:

- Decommissioning of the Waste Tank Farm;
- Remediation of lagoons, sludge ponds and water treatment systems;
- Removal and disposal of facility foundations and contaminated soil;
- Decommissioning and removal of the Remote-Handled Waste Processing Facility;
- Installation of erosion controls and environmental monitoring requirements;
- Implementation of other actions as consistent with the Decommissioning Environmental Impact Statement and Record of Decision;
- Construction of High-level Waste Canister Load-out Facility and a Dry Storage Facility;
- Moving high-level waste canisters from the Main Plant Processing Facility to the Dry Storage Facility;
- Final decommissioning of the Main Plant Process Building and the Vitrification Facility, consistent with Decommissioning Environmental Impact Statement Record of Decision;
- Demolition and removal of any other interim storage support facilities.
- Future demolition and removal of the Dry Storage Facility and support facilities;

- Transition of the site back to the State of New York.

Regulatory Framework

Cleanup and environmental remediation activities at West Valley are governed by the following statutes, regulations, and agreements:

- The West Valley Demonstration Project Act (Public Law 96-368) required the Secretary of Energy to carry out a high-level radioactive waste management project at the Western New York Nuclear Services Center.

- Cooperative Agreement between DOE and New York State Energy Research and Development Authority (1980, amended 1981) implements of the West Valley Demonstration Project Act of 1980. It allows DOE use and control of the 165-acre West Valley Demonstration Project premises and facilities for the purposes and duration of the Project.

- Memorandum of Understanding between DOE and Nuclear Regulatory Commission (1981) identifies roles, responsibilities, terms and conditions agreed to regarding Nuclear Regulatory Commission review and consultation during the course of the Project.

- Stipulation of Compromise Settlement agreement (1987) represents the legal compromise reached between the Coalition on West Valley Nuclear Waste and Radioactive Waste Campaign and the DOE regarding development of a comprehensive Environmental Impact Statement for the Project and for on-site and off-site disposal of low-level waste.

- Supplemental Agreement to the Cooperative Agreement (1991) sets forth special provisions for the preparation of a joint Environmental Impact Statement between the DOE and New York State for facility decommissioning.

- Resource Conservation and Recovery Act 3008(h) Administrative Order on Consent (1992) between the United States Environmental Protection Agency, the New York State Department of Environmental Conservation, DOE and New York State Energy Research and Development Authority regarding Resource Conservation and Recovery Act.

- Cooperative Agreement between the Seneca Nation of Indians and the West Valley Demonstration Project (1996) establishes a framework for inter-governmental relationships between the Seneca Nation of Indians and the DOE with respect to Project activities.

- The Final Environmental Impact Statement for Decommissioning and/or Long Term Stewardship and the associated Record of Decision are scheduled for completion in March 2010. The preferred alternative is Phased Decision making in which the decommissioning would be completed in two phases. Phase 1 activities are expected to take eight to ten years to complete. In addition, during the first phase, this alternative provided for additional site characterization and scientific studies to facilitate consensus decision making for the remaining facilities or areas.

  A Phase 2 decision would be made within ten years after the initial DOE Record of Decision and New York State Energy Research and Development Authority Findings Statement if the Phased Decision making Alternative is selected.

Critical Site Uncertainties and Assumptions

The following assumptions support the planning basis for achieving Interim End State completion:

- The Project will be able to disposition higher activity low-level waste off-site, without obstruction, consistent with the 2005 Waste Management Record of Decision.
- Supplemental analyses and amendments to the Record of Decision, as necessary, will allow for off site disposition of other Project waste (e.g., transuranic waste).
- A defense determination for the Project's transuranic waste will be made in FY 2010, which will determine the disposition pathway for this waste. Due to uncertainties in the outcome of the defense determination, the Project's transuranic waste has been integrated into the Department's ongoing Greater Than Class C low-level waste disposal EIS. If a defense determination is made, the defense portion of the waste stream could then be integrated into the complex-wide shipping schedule to support off-site disposition at the Waste Isolation Pilot Plant beginning in FY 2010.
- New York State Energy Research and Development Authority will continue as a joint lead agency in the Environmental Impact Statement process.

The largest uncertainty for defining remaining project scope is the outcome of the Environmental Impact Statement and the Record of Decision.

Interdependencies

Completing the West Valley Demonstration Project Act requires off-site disposal of low-level waste, mixed low-level waste, transuranic waste, and high-level waste. Thus, the project is dependent on other sites for these disposal services. Disposal of non-defense transuranic waste is currently dependent on completion of the Greater Than Class C low-level waste disposal EIS and resulting record(s) of decision.

Contract Synopsis

The contract for completion of the Interim End State at West Valley Demonstration Project was awarded to West Valley Environmental Services in June 2007 and will continue through June 2011. DOE anticipates awarding a contract for implementing the Decommissioning Environmental Impact Statement Record of Decision in 2011.

Cleanup Benefits

West Valley Demonstration Project plans to achieve Interim End State completion in FY 2011. At that point, all of the work that can be accomplished within current regulatory authorities will have been completed including off-site disposition of low-level waste and other waste with a pathway for disposal, decontamination and demolishment of facilities and infrastructure no longer needed to support safe site operations, and decontamination of the Main Plant Process Building. The site will then implement the Decommissioning Environmental Impact Statement Record of Decision issued in 2010.

Funding Schedule by Activity

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Non-Defense Environmental Cleanup			
West Valley Demonstration Project			
OH-WV-0013 / Solid Waste Stabilization and Disposition-West Valley	21,003	12,639	15,917
OH-WV-0040 / Nuclear Facility D&D-West Valley	44,497	45,435	42,157
Subtotal, West Valley Demonstration Project	65,500	58,074	58,074

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
West Valley Demonstration Project					
Geographic Sites Eliminated (number of sites)	0	0	0	1	0%
High-Level Waste packaged for final disposition (Number of Containers)	275	275	275	275	100.0%
Industrial Facility Completions (Number of Facilities)	13	14	29	29	100.0%
Liquid Waste in Inventory eliminated (Thousands of Gallons)	814	814	814	814	100.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	27,986	27,986	29,899	29,899	100.0%
Nuclear Facility Completions (Number of Facilities)	3	4	12	14	85.7%
Radioactive Facility Completions (Number of Facilities)	4	4	6	13	46.2%
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	571	1,142	50.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	277	555	49.9%

Detailed Justification

	(dollars in thousands) FY 2009	FY 2010	FY 2011
OH-WV-0013 / Solid Waste Stabilization and Disposition-West Valley	**21,003**	**12,639**	**15,917**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The solid waste stabilization and disposition project at the West Valley Demonstration Project involves

(dollars in thousands)

FY 2009	FY 2010	FY 2011

the waste management activities required to disposition the low-level and transuranic waste produced as a result of high level waste solidification activities. When this project is completed, all West Valley Demonstration Project-generated, low-level waste and transuranic wastes will have been shipped off-site for disposal, reducing worker and environmental risk at the site. In order to prepare for waste disposition efforts associated with transuranic and other high activity waste, a Remote-Handled Waste Facility has been constructed, which provides the capability to safely characterize, size reduce, package and prepare high activity and transuranic waste for off-site shipment and disposal.

In FY 2011, the following activities are planned:

- Continue processing and disposal of legacy mixed low level waste and legacy low level waste generated from the decontamination of the Main Plant Process Building.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Liquid Waste in Inventory eliminated (Thousands of Gallons)	814	814	814	814	100.0%
High-Level Waste packaged for final disposition (Number of Containers)	275	275	275	275	100.0%
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	571	1,142	50.0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	277	555	50.0%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	27,986	27,986	29,899	29,899	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue waste disposition operations for remediation low-level waste. (FY 2009)
- Complete operation of the Remote-Handled Waste Facility. (September 2011)

OH-WV-0040 / Nuclear Facility D&D-West Valley	**44,497**	**45,435**	**42,157**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The decontamination and decommissioning program at the West Valley Demonstration Project encompasses the facilities, tanks and hardware used during high-level waste solidification efforts. Decontamination and decommissioning activities are current subject to a Final Environmental Impact Statement scheduled for completion in March 2010. In advance of the Final Environmental Impact Statement, DOE continues progress toward the Interim End State contract, awarding West Valley Environmental Services to decontaminate the Main Plant Process Building to make it demolition-ready and remove ancillary facilities not needed for managing the high level waste. Once an Environmental Impact Statement Record of Decision is issued, the decontamination and decommissioning will be

(dollars in thousands)

FY 2009	FY 2010	FY 2011

performed consistent with the Nuclear Regulatory Commission criteria and the Record of Decision to most effectively reduce worker, public, and environmental risks. In December 2009, DOE submitted a Decommissioning Plan for the Main Plant Process Building to the Nuclear Regulatory Commission. DOE is in the process of responding to the Nuclear Regulatory Commission's Request for Additional Information and anticipates Nuclear Regulatory Commission providing their Technical Evaluation Report in February 2010. To support decontamination and decommissioning efforts, safety management and maintenance at the site are in compliance with federal and state statutes, as well as DOE orders and requirements.

In FY 2011, the following activities are planned:

- Continue decontamination of the Main Plant Process Building.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding.
- Maintaining essential services for the site.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	3	4	12	14	86.0%
Radioactive Facility Completions (Number of Facilities)	4	4	6	13	46.0%
Industrial Facility Completions (Number of Facilities)	13	14	29	29	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Issue Draft DEIS for Review (FY 2009)
- Continue dismantlement/removal of 2 facilities and structures no longer necessary to support safe site operations (FY 2009)
- Complete dismantlement/removal of 10 facilities and structures no longer necessary to support safe site operations. (June 2010)
- Complete dispositioning/decontamination of 4 cells/rooms former spent nuclear fuel processing facility and 1 room; cell in the Vit Facility. (June 2010)
- Decontaminate 26 cells/rooms/ancillary facilities (September 2010)
- WVDP Interim End State Completion - Process building (Former Spent Nuclear Fuel Reprocessing Facility decontaminated and put in a cost effective condition for high-level waste canister storage, low-level waste, and transuranic waste shipped off-site for disposal, non-essential facilities demolished or removed (foundations remain. (September 2011)

	FY 2009	FY 2010	FY 2011
Total, West Valley Demonstration Project	**65,500**	**58,074**	**58,074**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Non-Defense Environmental Cleanup	
West Valley Demonstration Project	
OH-WV-0013 / Solid Waste Stabilization and Disposition-West Valley	
▪ Increase in funding allows completion of the Interim End State scope by 2011; while continuing processing and disposal of newly generated waste; processing of high activity low-level and transuranic waste through the remote-handled waste facility; and packaging and storage of contact-handled and remote-handled transuranic waste.	3,278
OH-WV-0040 / Nuclear Facility D&D-West Valley	
▪ Decrease in funding reflects the effect of the site's shift in focus to concentrate on higher – priority solid waste stabilization work.	-3,278
Total, West Valley Demonstration Project	**0**

All Other Sites

Funding by Site and Location

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
All Other Sites				
Completed Sites/Program Support	1,100	0	1,200	0
Brookhaven National Laboratory	8,433	42,355	15,000	13,861
California Site Support	187	0	262	0
Argonne National Laboratory	19,479	98,500	10,000	0
Energy Technology Engineering Center	15,000	54,175	10,500	10,679
Inhalation Toxicology Laboratory	272	0	0	0
Moab	40,699	108,350	39,000	31,000
Tuba City	5,000	0	0	0
SLAC National Accelerator Laboratory	4,883	7,925	7,100	3,526
Total, All Other Sites	95,053	311,305	83,062	59,066

The Environmental Management program scope includes cleanup, closure, and post-closure environmental activities at a number of geographic sites across the nation. Most of the sites described in this section of the budget are aligned organizationally with other Department of Energy programs, particularly the Office of Science, and may have continuing missions after EM completes cleanup. Some sites, however, belong to EM and are in the final stages of cleanup and closure or have actually transitioned to post-closure. The sites included in this section are Argonne National Laboratory, Brookhaven National Laboratory, Energy Technology Engineering Center, Inhalation Toxicology Laboratory, Lawrence Berkeley National Laboratory, Moab, and the Stanford Linear Accelerator Center. Below is an overview of the geographic sites that are included in this section of the budget. Sites included in the Non-Defense Post Closure Administration and Program Support are: Energy Technology and Engineering Center, General Electric – Vallecitos, Inhalation Toxicology Laboratory in New Mexico, EM work at Stanford Linear Accelerator Center in California, Argonne National Laboratory in Illinois, Brookhaven National Laboratory in New York, and former Uranium Mill Tailings Remediation Act contractors.

Argonne National Laboratory

Site Overview

Argonne National Laboratory is a DOE Office of Science research and development laboratory with a broad program of research in basic energy and related sciences (such as physical, chemical, material, computer, biomedical and environmental) including operation of several large scientific user facilities. The Laboratory is located about 27 miles southwest of downtown Chicago.

American Recovery and Reinvestment Act Activities

The Argonne National Laboratory American Recovery and Reinvestment Act activities are funded at $98,500,000. Specifically, this funding will be used to accelerate demolition of excess contaminated facilities and waste cleanout activities. This work includes demolition of Building 330 and the characterization, decontamination and demolition of Building 310, including the below-ground structures, and off-site disposal of the resulting wastes and debris.

In addition, American Recovery and Reinvestment Act funding will provide for the removal of remote-handled transuranic waste from a number of buildings on-site for direct disposal to the Waste Isolation Pilot Plant; and for the removal of additional contact-handled transuranic waste for consolidation at another DOE site. ARRA funding will also be used for the removal of excess materials from the Alpha Gamma Hot Cell, including packaging and disposition of the cell waste and removal of excess nuclear materials from this facility which is a Category 2 (medium level) nuclear facility resulting in a significant achievement for the cleanup of the Argonne National Laboratory.

Site Description

The Argonne National Laboratory cleanup involves two key projects: (1) Long Term Stewardship for Soil and Water Remediation (PBS CH-ANLE-0030); and (2) Nuclear Facility decontamination and decommissioning (PBS CH-ANLE-0040). Post-cleanup residual contamination still remains in several areas of the Argonne National Laboratory site, which require continued monitoring and/or remediation system operation.

The Illinois Environmental Protection Agency has formally issued all "No Further Actions" as appropriate and has signed the Land Use Control Memorandum of Agreement requiring Argonne to maintain the remedial actions and groundwater monitoring. Transfer of groundwater monitoring and surveillance responsibilities to the Office of Science will occur in FY 2010.

Site Cleanup Strategy/Scope of Cleanup

Corrective actions to address contaminated soils and groundwater were conducted under the site Resource Conservation and Recovery Act permit. All corrective actions were completed at the end of FY 2003, with the exception of ongoing activities such as operation and maintenance of remedial actions and groundwater extraction systems, routine groundwater monitoring, and periodic inspection of engineered barriers. Site cleanup focus became completion of the remaining decontamination and decommissioning project. At the end of FY 2008, twelve nuclear facilities were decontaminated and decommissioned, and the final facility (Building 301) was completed in October 2009.

Site Completion (End State)

Current EM site cleanup work was completed in October 2009, along with required regulatory actions.

Site completion for the current EM scope does not include the additional excess facilities and materials that will transfer from the Office of Science to EM in the future. The additional excess remote and contact handled transuranic wastes transferring to EM will require treatment and eventual disposal at the Waste Isolation Pilot Plant.

Regulatory Framework

Corrective actions to address contaminated soils and groundwater were conducted under the Argonne site Resource Conservation and Recovery Act permit with the Illinois Environmental Protection Agency.

Critical Site Uncertainties and Assumptions

Site completion occurred in October 2009 involving the shipment for disposal of remote-handled transuranic waste. There were no critical site uncertainties associated with the Building 301 project.

Interdependencies

The Argonne Site Office and Argonne National Laboratory work with various State of Illinois agencies such as Illinois Environmental Protection Agency, Illinois Emergency Management Agency, and the State Historic Preservation Agency to execute remaining EM scope. Wastes are typically disposed to local landfills as solid sanitary wastes or to off-site commercial low-level waste disposal sites or the Nevada Test Site for radioactive wastes. Final disposal of the remote-handled transuranic waste required that the Waste Isolation Pilot Plant facility continue to accept remote-handled transuranic waste, and that the shipping corridor remain available from Argonne National Laboratory to the Waste Isolation Pilot Plant.

Contract Synopsis

The current major contract in place for Argonne National Laboratory is a Management and Operating contract. A performance-based management contract was awarded on July 31, 2006, to a new entity, UChicago Argonne LLC, and transition was completed by October 1, 2006.

Cleanup Benefits

Cleanup of additional proposed excess contaminated facilities, and disposal of the additional remote and contact-handled transuranic waste, will reduce the nuclear footprint at Argonne National Laboratory, decrease potential future risk, and demolish aging contaminated buildings that have no foreseeable future use.

Brookhaven National Laboratory

Site Overview

The Brookhaven National Laboratory is a U.S. Department of Energy (DOE) owned multi-disciplinary scientific research center located in the center of Suffolk County on Long Island, about 60 miles east of New York City. The Brookhaven Environmental Management Completion Project addresses the cleanup of the Brookhaven National Laboratory Superfund site as well as the decontamination and decommissioning of two former research reactors: the High Flux Beam Reactor and Brookhaven Graphite Research Reactor. Cleanup criteria are established under a 1992 Interagency Agreement among DOE, the U.S. Environmental Protection Agency, and the New York State Department of Environmental Conservation. The Brookhaven Environmental Management Completion Project is to be considered complete when all required groundwater treatment plants are built and operating, cleanup of soils and the Peconic River are complete, decontamination and decommissioning of the Brookhaven Graphite Research Reactor and the High Flux Beam Reactor are complete, all cleanup, decontamination and decommissioning and legacy wastes are disposed of off-site, and an effective Long-Term Environmental Operations, Safety and Security program was underway.

American Recovery and Reinvestment Act Activities

The Brookhaven National Laboratory American Recovery and Reinvestment Act activities are funded at $42,355,000. Specifically, this funding will accelerate the removal of the graphite pile from the Brookhaven Graphite Research Reactor, resulting in approximately 60,000 blocks, which will be packaged and prepared for shipping and disposed of off-site, and demolish surplus ancillary structures. American Recovery and Reinvestment Act funding will also be used to accelerate the removal of the A/B waste lines, and contaminated soils at the Former Hazardous Waste Management Facility perimeter area, and the decommissioning and decontamination of two Fan Houses, and isolation of Building 750.

Site Description

Groundwater cleanup is Brookhaven National Laboratory's highest priority because Long Island's sole source aquifer provides the only source of drinking water for local residents. Off-site groundwater is contaminated with volatile organic compounds above State standards and onsite groundwater is contaminated above the drinking water standard with volatile organic compounds and radionuclides tritium and strontium-90. Some soils at Brookhaven National Laboratory are contaminated with radionuclides (primarily cesium-137 and strontium-90) and chemicals (primarily mercury) due to historical practices and spills.

Brookhaven Graphite Research Reactor: The Brookhaven Graphite Research Reactor was the first reactor built solely to provide neutrons for research and was operated from August 1950 to June 1968. This reactor is of concern because releases to the environment have occurred and have caused soil and groundwater contamination with cesium-137 and strontium-90. It is listed as an Area of Concern in the Interagency Agreement. Numerous interim actions have been performed to address high priority environmental releases. A Record of Decision was signed by the United States Environmental Protection Agency in March 2005 that adopts the interim actions as final and requires removal and off-site disposal of the graphite moderator (pile) and radiation biological shield (bioshield).

High Flux Beam Reactor: The High Flux Beam Reactor, constructed for basic research experiments in physics, chemistry and biology, was permanently shut down in 1999. Decision-making with the regulatory agencies and the community is completed, and culminated with a signed Record of Decision during the summer of 2009 along with the removal and disposal of Control Rod Blades and Beam Plugs in addition to the soil remediation of the Waste Loading Area.

Site Cleanup Strategy/Scope of Cleanup

Brookhaven National Laboratory's highest cleanup priorities involved the cleanup of environmental releases to groundwater, soils, and the Peconic River. These activities make up the CH-BRNL-0030/ Soil and Water Remediation project. High priority activities at the Brookhaven Graphite Research Reactor related to addressing environmental releases were completed in FY 2005. Removal of the reactor internals, graphite moderator (pile), and radiation biological shield (bioshield) are planned for completion in FY 2010. After the removal and off-site disposal of the reactor internals, graphite pile and reactor bioshield an engineered cap around the building and groundwater monitoring wells will be installed. Decontamination and decommissioning of the High Flux Beam Reactor is considered to be the lowest risk and is scheduled to be completed last.

Site Completion (End State)

Completion of the Brookhaven National Laboratory Soil and Water activities in FY 2005 was followed by continuing Long-Term Environmental Operations, Safety, and Security. These activities will continue while the Brookhaven Graphite Research Reactor and High Flux Beam Reactor decontamination and decommissioning is completed. The lifecycle planning estimate for end date for legacy cleanup is 2011. Upon completion of the above currently identified scope within each of the project's Record of Decisions, the Long-Term Environmental Operations, and Safety and Security program will be transferred to the DOE Office of Science, the Brookhaven National Laboratory site landlord.

Regulatory Framework

Brookhaven National Laboratory was added to New York State's list of Inactive Hazardous Waste sites in 1980 and to the federal National Priorities List in 1989. A tri-party Federal Facilities Compliance Agreement, also known as the Interagency Agreement, was subsequently negotiated among the DOE, the U. S. Environmental Protection Agency - Region II, and the New York State Department of Environmental Conservation. The Interagency Agreement integrates the requirements of Comprehensive Environmental Response, Compensation, and Liability Act, the corrective action requirements of the Resource Conservation and Recovery Act, DOE cleanup authorities under the Atomic Energy Act, and any corresponding New York State regulations.

Critical Site Uncertainties and Assumptions

Up through calendar year 2008 the most significant project uncertainty for the High Flux Beam Reactor involved the resolution of the end state with the regulatory agencies and the public. The current assumption involves removing accessible source terms and shrinking the footprint of the facility to reduce long-term surveillance, maintenance and security requirements, and to defer removal of the reactor vessel for 40 to 75 years. This will allow the high source terms to radiologically decay, reducing the risk of radiation exposures to workers during removal and packaging. Deferral of the vessel removal will also greatly simplify the dismantlement, segmentation and packaging of the vessel and will reduce the need for specialized shipping casks and containers to transport the highly radioactive components, reducing the generation of secondary waste streams. DOE continues using the Core Team process with the regulatory agencies and facilitated this decision, and a Record of Decision addressing the end state of the High Flux Beam Reactor was signed in the summer of 2009.

Interdependencies

Waste transportation and disposal constitute the most significant inter-site dependencies. Radioactive waste from decontamination and decommissioning will be disposed of at Nevada Test Site and Energy Solutions in Clive, Utah, (formerly Envirocare of Utah).

Contract Synopsis

DOE's cost-plus-performance-fee contract with Brookhaven Science Associates, as the managing and operating contractor, to perform the DOE science mission at Brookhaven National Laboratory ended on January 4, 2008, but was extended through January 2016. EM-funded cleanup activities involving the completion of the Brookhaven National Laboratory Soil and Water activities, high-priority removals at the Brookhaven Graphite Research Reactor and the High Flux Beam Reactor, and surveillance and maintenance activities at both Reactors are included in this contract.

Cleanup Benefits

Environmental restoration and nuclear facility decommissioning at Brookhaven National Laboratory addresses historical releases by mitigating risks to human health and the environment. Radiological and chemical contamination has been removed, reduced or placed under an active remediation system designed to isolate, and remediate the contamination. The overall benefit is a workplace and environment where immediate threats of exposure to contamination have been mitigated.

Overall, cleanup at Brookhaven National Laboratory, as executed under the Comprehensive Environmental Response, Compensation, and Liability Act and the Brookhaven interagency agreement, designed to take near-term action to reduce the immediate threats to human health and the environment from historical releases of contamination. Long-term actions are a key part of the cleanup strategy with the overall goal of delisting from the National Priorities List.

Soil contamination has been either removed or placed in a safe and stable condition. Groundwater contamination is being addressed by a suite of remediation technologies designed to isolate and remediate the contamination and reduce overall risks. All soil, groundwater and Peconic River response actions are constructed and in various phases of operation and monitoring. Sources of releases have been removed and contamination from inactive nuclear facilities has been addressed in a variety of facility stabilization, decontamination and decommissioning activities. Final decommissioning is underway.

At the Brookhaven Graphite Research Reactor, removal of the reactor, which includes the reactor internals, the graphite moderator (pile), and the radiation biological shield (bioshield), is the high priority activity that will ultimately remove over 99 percent of the total radiological inventory. The High Flux Beam Reactor is in a safe and stable condition. Environmental releases have been addressed and the facility has undergone extensive stabilization and decontamination. The remaining work is designed to further reduce its radiological inventory at the site. However, because of the high radiation levels associated with final decommissioning, consideration of radioactive decay to safer levels has been evaluated as part of the Comprehensive Environmental Response, Compensation, and Liability Act response action selection process; such the remaining radiological inventory will be addressed.

Energy Technology Engineering Center

Site Overview

The Santa Susana Field Laboratory, owned by the Boeing Company and NASA, is located atop a range of hills between the populous Simi and San Fernando Valleys, north of Los Angeles. The 90-acre Energy Technology Engineering Center, which was DOE's laboratory for nuclear research (non-defense) at the Santa Susana Field Laboratory (2,850 acres), is a collection of facilities within Area IV.

American Recovery and Reinvestment Act Activities

The Energy Technology and Engineering Center American Reinvestment and Recovery Act activities are funded at $54,175,000. Specifically, this funding will provide the U.S. Environmental Protection Agency to conduct radiological characterization survey assessment, as required of DOE by a congressional mandate, necessary to complete an environmental impact statement and enable completion of site cleanup. American Recovery and Reinvestment Act funding will also supplement on-going Resource Conservation and Recovery Act Facility Investigations and Resource Conservation and Recovery Act Corrective Action for soil and groundwater Solid Waste Management Units and Operable Units.

Site Description

The Energy Technology Engineering Center is surplus to DOE's current mission and is operated by EM solely to complete site cleanup and closure. As such, the current use of the site involves diminishing use of facilities through deactivation, decommissioning, and dismantlement. As a result of past operations, radioactive and chemical contamination exists in several structures (including the Radioactive Materials Handling Facility) and soil, surface, and groundwater.

Site Cleanup Strategy/Scope of Cleanup

Two radiological facilities (comprising 11 buildings) and two sodium facilities (comprising four buildings) remain. The two radiological facilities remaining at Energy Technology Engineering Center are the Radioactive Materials Handling Facility complex (which has a Resource Conservation and Recovery Act permit) and Building 4024 (part of the space nuclear program). There are two sodium facilities: 1) Sodium Pump Test Facility; and 2) the Hazardous Waste Management Facility. In addition, there is an ongoing Resource Conservation and Recovery Act Corrective Action for chemical contamination investigation in soil and groundwater.

DOE is responsible for ten areas of soil contamination that require investigation and potential remediation at Energy Technology Engineering Center. Corrective actions are currently based on a residential land-use assumption. It is anticipated that three to six of the ten units will be excavated to meet projected media cleanup standards.

Three small plumes are contaminated primarily with low levels of trichloroethylene and are included in the site wide Resource Conservation and Recovery Act Corrective Action Program. The Corrective Action program for DOE activities is a small part of the activity for the entire Santa Susana Field Laboratory. The state, which is the regulatory authority, will not allow DOE to proceed independently from the rest of the site. The long-term response actions for the DOE groundwater contamination were transferred to Boeing as part of the 1998 Closure Contract.

Site Completion (End State)

Due to an existing Consent Order and a recent court order to complete an Environmental Impact Statement, the lifecycle planning estimate range is 2018 to 2025. A new acquisition strategy is being developed, as is a strategy for completion of the project scope. Following is a list of remaining activities that are currently projected to achieve EM completion:

- Preparation of the Environmental Impact Statement and Record of Decision.
- Decontamination and demolition of two remaining radiologically contaminated facilities.
- Contaminated Soil and Groundwater Investigation and Cleanup in accordance with the Resource and Recovery Act.
- Demolition of two sodium facilities (not radiologically contaminated). One of the facilities also requires closure pursuant a Resource Conservation and Recovery Act Closure Plan.
- Offsite disposal of all radioactive waste and decommissioned waste.

Regulatory Framework

Regulation of the Energy Technology Engineering Center Closure project is segmented by different regulatory authorities. Prior decontamination and demolition activities of the radiologically contaminated facilities at the Energy Technology Engineering Center site were conducted under Atomic Energy Act authority. The U.S. District Court for the Northern District of California directed the DOE to complete an Environmental Impact Statement and Record of Decision for Area IV of the Santa Susana Field Laboratory in accordance with the National Environmental Policy Act.

The Resource Conservation and Recovery Act chemical cleanup is regulated by the California Department of Toxics Substance Control and is being performed consistent with a signed Consent Order issued by the California Department of Toxic Substances Control in August 2007. DOE is presently renegotiating a revised Resource Conservation and Recovery Act Consent Order and associated schedule for the decontamination and decommissioning work which has been deferred at the Radioactive Material Handling Facility.

State law enacted in January 2008 requires cleanup actions consistent with an agricultural scenario. The agricultural scenario is more restrictive than previously performed cleanup actions at the Energy Technology Engineering Center.

Critical Site Uncertainties and Assumptions

DOE has been ordered to prepare an Environmental Impact Statement and issue a Record of Decision regarding cleanup at Energy Technology Engineering Center. Until the Record of Decision is issued, the full work scope for remediation this site remains uncertain. Further, risks to EM completion at Energy Technology Engineering Center include potential delays in State environmental reviews and final acceptance by the regulators of DOE's approach to soil and groundwater characterization and containment.

The FY 2008 DOE Appropriation language required DOE and the Environmental Protection Agency to enter into an Interagency Agreement for the joint implementation of a radiological characterization survey of the Santa Susana Field Laboratory Area IV. Following additional Congressional input, DOE provided funds to the Environmental Protection Agency to perform an offsite radiological background study via an Interagency Agreement in July 2008. The Environmental Protection Agency survey is a direct input to the Environmental Impact Statement. This survey will be funded by the 2009 American Reinvestment and Recovery Act appropriation.

Contract Synopsis

The current cleanup contract (through September 30, 2011) is held by Boeing. It is a cost-plus-fixed fee/incentive fee contract. The scope is comprehensive in that it includes all of the radioactive contamination (remediated under DOE's Atomic Energy Act authority) and chemical contamination, conducted under the state of California's Resource Conservation and Recovery Act authority.

Cleanup Benefits

The cleanup is protective of human health and the environment using a residential land use scenario. Activities in FY 2009 and FY 2010 will fulfill the congressionally mandated radiological characterization survey and provide assurance that all aspects of radiological contamination on the site have been identified and will be addressed. It also will help ensure all other hazardous soil and groundwater contamination has been identified and allow the DOE to proceed with environmental clean-up and closure.

Moab

Site Overview

The project mission is to remediate uranium mill tailings from the former Atlas Minerals Corporation (Atlas) uranium-ore processing and mill site, contaminated vicinity properties, and contaminated groundwater. DOE became responsible for this mission upon the enactment of the Floyd D. Spence National Defense Authorization Act of 2001. The scope of the Moab UMTRA Project is to excavate approximately 16 million tons of uranium mill tailings and other contaminated material from the former Atlas uranium mill site near Moab, Utah; transport them approximately 30 miles primarily via rail to a disposal cell to be constructed near Crescent Junction, Utah; remediate vicinity properties; and implement active ground water remediation at the Moab site

American Recovery and Reinvestment Act Activities

The Moab American Reinvestment and Recovery Act activities are funded at $108,350,000. Specifically, this funding will be used to accelerate the removal of 2 million tons of tailings and accelerate completion of the site cleanup by three years, from 2028 to 2025.

Site Description

The DOE Moab project site is approximately 3 miles northwest of the city of Moab, Utah on the west bank of the Colorado River. The site encompasses approximately 435 acres, 130 acres of which is covered by a 12 million cubic yard uranium mill tailings pile..

Site Cleanup Strategy/Scope of Cleanup

DOE's Record of Decision (issued on September 14, 2005) made the decision to relocate the mill tailings pile away from the Colorado River to a DOE-constructed disposal facility near Crescent Junction, Utah via rail transportation. DOE will assess the extent of radiological contamination at the mill site and vicinity properties, characterize the proposed disposal site and construct a disposal cell, excavate and remove the tailings pile to the disposal cell, and remediate local ground water. The remainder of the mill site will be verified to meet radiological standards and then restored to an acceptable condition. Demobilization from the site will complete the on-site activities, except in the case of active ground water restoration. DOE also will investigate unidentified vicinity properties to assess the presence of contamination levels.

Site Completion (End State)

The end state for the Moab Site Project will be achieved after contaminated soil, tailings, vicinity properties, and surface and groundwater are remediated. DOE may place some restrictions on reutilization of the site, depending on how proposed land uses could impact the selected groundwater remedy. The site will then be transferred to the Office of Legacy Management for monitoring and required stewardship. The end state is projected to be 2025.

Regulatory Framework

In October 2000, the Floyd D. Spence National Defense Authorization Act of FY 2001 assigned DOE responsibility to establish a remedial action program and stabilize, dispose of, and control uranium mill tailings and other contaminated material at the Moab uranium-ore processing site and associated vicinity properties. Remediation must be performed in accordance with Title I of the Uranium Mill Tailings Radiation Control Act and the cleanup standards established under 40 CFR 192. The Nuclear Regulatory Commission must concur on the remediation plan.

Critical Site Uncertainties and Assumptions

- Potential rail upgrades and rail transport will be accomplished within expected project cost and schedule.
- Vicinity property characterization will minimize the number of sites requiring remediation.

Interdependencies

Past surveys by the Environmental Protection Agency indicate contaminated vicinity properties may exist and consequently will have to be remediated to Environmental Protection Agency standards. Contaminated materials will be excavated and transported to the disposal cell location.

Contract Synopsis

A remedial action contract and a new technical assistance contract were awarded on June 20, 2007.

Cleanup Benefits

Continued maintenance and surveillance of the groundwater and mill tailings pile area will ensure no further contamination of surrounding areas. Initiating the removal of the approximately 12 million cubic yards of uranium tailings away from the Colorado River will begin to significantly reduce danger to human health and the environment.

SLAC National Accelerator Laboratory

Site Overview

The objectives of EM's remediation project at the SLAC National Accelerator Laboratory are to conduct necessary response actions to a California Regional Water Quality Control Board (Water Board) Order No. R2-2005-0022, issued May 2005. The Order requires necessary long-term groundwater remedies, excavation and disposal of contaminated soils, and transfer of responsibility for long-term operation and maintenance of groundwater treatment systems to the Office of Science at the end of FY 2012 upon project completion. The Oakland Projects Office will oversee the work scope between the Management and Operations contractor and an Indefinite Delivery/Indefinite Quantity contractor. Identified sites will be characterized in order to guide removal actions. The groundwater release sites will be studied and necessary monitoring wells and groundwater treatment systems will be installed.

American Recovery and Reinvestment Act Activities

The SLAC National Accelerator Laboratory American Recovery and Reinvestment Act activities are funded at $7,925,000. Specifically, this funding will help the project to achieve its 2011 completion goal which is one year earlier than planned. The American Recovery and Reinvestment Act work consists of soil excavation, transportation, disposal, sampling and restoration at ten waste sites and remedial investigations to be conducted at four sites. Approximately 20,000 cubic yards of contaminated soil will be disposed, reducing the EM project footprint by 10 acres. Meeting these objectives will allow DOE-EM to: fulfill ongoing obligations as defined in the DOE lease with Stanford University (April 26, 1962); perform EM's mission of legacy contamination cleanup; comply with the Water Board Order and achieve EM completion of the SLAC National Accelerator Laboratory remediation project. It is expected that EM completion will achieve protection of groundwater and residential land use standards for accessible areas.

Site Description

The SLAC National Accelerator Laboratory is a Federally funded national research laboratory constructed in 1963 and continuously managed and operated by Stanford University under a contract with the United States Department of Energy (DOE). It is located on land owned by Stanford University and leased to DOE. The original lease agreement was signed in 1962 between the Atomic Energy Commission (DOE's predecessor) and Stanford University for a period of 50 years, expiring in 2012. The land containing facilities is part of the original land grant that established Stanford University; the land cannot be sold and must be held in perpetuity by Stanford's trustees to support its educational mission. Land use at the facility is a combination of industrial, educational, and short-term residential. DOE's lease with Stanford University requires "leaving the premises in a safe, clean, and neat condition."

The SLAC National Accelerator Laboratory research program centers on experimental and theoretical research in elementary particle physics using electron beams and a broad program of research in atomic and solid-state physics, chemistry, biology, and medicine using synchrotron radiation. The main accelerator is two miles long – the longest linear accelerator in the world. It is located approximately two miles west of the main Stanford University campus adjacent to Menlo Park in an unincorporated portion of San Mateo County that is residentially zoned.

Site Cleanup Strategy/Scope of Cleanup

Soil and Groundwater Pollution

The SLAC National Accelerator Laboratory has conducted numerous site investigations as part of its overall Environmental Restoration Program that include extensive soil and groundwater sampling, and the installation of over 100 groundwater monitoring wells. Results of these investigations indicate that soil and groundwater pollution exists at various locations within the SLAC National Accelerator Laboratory site. Constituents of concern for soil are: volatile organic compounds, semi-volatile organic compounds, total petroleum hydrocarbons, polychlorinated biphenyls, lead and tritium. Constituents of concern for groundwater are volatile organic compounds, semi-volatile organic compounds, total petroleum hydrocarbons and tritium. Source areas that contribute to pollutant releases include storage areas and areas where hazardous materials, including volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, total petroleum hydrocarbons, and radionuclides were used or generated. The volatile organic compounds were used as cleaning agents and the polychlorinated biphenyls were used in electrical transformers. Polychlorinated biphenyls are no longer used at the SLAC National Accelerator Laboratory in transformers at concentrations above 500 parts per million. All transformers with polychlorinated biphenyls concentrations above 500 parts per million have been drained, flushed and refilled with non-polychlorinated biphenyls containing oil; however, some residual polychlorinated biphenyls remain in transformers. Generation of radionuclides is the result of facility operations for high-energy particle physics research. Some of these chemicals have been released to the environment, including site soil, groundwater, sediment, and storm water. Several removal actions have been performed for volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls, total petroleum hydrocarbons, and metals in soil and groundwater. Currently, evaluation of remedial alternatives addressing soil and groundwater pollution is ongoing.

EM and the Office of Science SLAC National Accelerator Laboratory partitioned project scope responsibilities based on whether the contamination (or suspected contamination) was "legacy waste," and thus was EM's responsibility, or operational/storm water management-type contamination, and thus was Office of Science SLAC National Accelerator Laboratory responsibility. It was agreed that in instances where release sites are inaccessible, or could not be currently assessed without interfering with the facility research operations (e.g., under buildings or located in active portions of the facility), the Office of Science SLAC National Accelerator Laboratory has accepted responsibility for them as deferred actions. EM's strategy is to perform the removal actions in parallel with preparing the Remedial Investigation Report and associated Risk Assessment, the presumption being that once the Remedial Investigation was completed, no, or very limited, additional response measures would be warranted such that any subsequent documentation could be streamlined or combined to meet the EM completion target date of September 30, 2011.

Site Completion (End State)

Based on existing project scope, EM completion is expected to achieve protection of groundwater and residential land use standards for accessible areas. Completion of removal actions and construction of remedial measures by the end of FY 2012, if based on original project scope, would demonstrate the following:

- contaminated soils excavated;
- contaminated sites evaluated and characterized;
- technical issues and concerns associated with new Board Order resolved by Core Team members prior to causing delays;
- Comprehensive Environmental Response, Compensation, and Liability Act public reviews and deliverables are completed: Remedial Investigation Report, Risk Assessment, Feasibility Study, Remedial Action Plan, Remedial Design Report, Remedial Action Plan Implementation Final Report and Operations and Maintenance Plan for the West SLAC National Accelerator Laboratory and Groundwater Operable Units and a Remedial Investigation and Risk Assessment for the Research Yard Operable Units;
- Enforceable regulatory milestones were achieved;
- Regulatory site closure was obtained
  - o Office of Science accepted responsibility for all sites that were inaccessible due to research operations and all contamination after EM completes existing scope; and
  - o Office of Science agreed to assume responsibility for completing the Comprehensive Environmental Response, Compensation, and Liability Act process for the remainder of the Research Yard and the Tritium Operable Units and new scope and reports required for new Board Order.

Regulatory Framework

The California Regional Water Quality Control Board, San Francisco Bay Region is the lead regulatory agency at the SLAC National Accelerator Laboratory Environmental Restoration Program for all media including soil, groundwater, sediment, and storm water. While the U.S. Environmental Protection Agency has regulatory authority regarding soil remedial actions involving polychlorinated biphenyls, it seeks no involvement as long as the Toxic Substances Control Act unrestricted use standards are applied. DOE is executing its Comprehensive Environmental Response, Compensation and Liability Act authority (Executive Order 12580) to conduct removal actions. The SLAC National Accelerator Laboratory work scope was stipulated under the California Regional Water Quality Control Board (Water Board) Order No. R2-2005-0022, issued May 2005. This Order required the investigation and remediation of impacted soil and groundwater resulting from the historical spills and leaks that have occurred during operations. Per the Order, a Remedial Investigation/Feasibility Study Work Plan was prepared and approved to facilitate preliminary agreements on whether cleanup actions are necessary for many of the sites. The release sites at issue are grouped into four operable units: Groundwater Volatile Organic Compound Operable Unit; Tritium Operable Unit; Research Yard-SSRL/IR-6 Drainage Channel Operable Unit; and, the West SLAC National Accelerator Laboratory/Campus Area / IR-8 Drainage Channel Operable Unit. A new Board Order was stipulated on October 14, 2009, resulting in a new unilateral modification to the Order (R2-2009-0072. This Board Order is discussed below in the section, "Critical Site Uncertainties and Assumptions."

Critical Site Uncertainties and Assumptions

Groundwater will be considered not drinkable (i.e., industrial or irrigation only). A 2001 evaluation documented that natural groundwater at the SLAC National Accelerator Laboratory does not quality as potable drinking water due to naturally poor quality and low well yields. The SLAC National Accelerator Laboratory in conjunction with the landowner, Stanford University, has proposed that the California Regional Water Quality Control Board exempt groundwater from all potential uses except freshwater replenishment, agricultural supply, irrigation supply and industrial process supply.

A new Board Order has expanded scope of an existing project threatening completion by 2011. On October 14, 2009, a new unilateral modification was made to the Order (R2-2009-0072) changing the definition of the "West SLAC Operable Unit" to encompass the entire SLAC National Accelerator Laboratory not otherwise covered by the other three operable units (approximately 400 acres of the site). Previously, the West SLAC National Accelerator Laboratory operable unit was considered only to include the identified release sites/problem areas encompassing a total of approximately 25-30 acres. As a result of this new Board Order, it is unclear whether new scope has been identified. EM may consider new scope as any reporting requirements that exceed what was previously defined as the EM Remedial Investigation report and Comprehensive Environmental Response, Compensation, and Liability Act documentation for the legacy waste sites. New scope for example could also include documentation of deferred/operational sites and their associated drainages and or evaluation of all existing data to determine if there may be other potential or suspect sites. The remaining uncertainties associated with the Remedial Investigation data and subsequent documentation (e.g., decision documents, risk management plans) will likely prevent attainment of the current project completion date. DOE and Stanford University have until April 10, 2010, to provide the Regulator with a new schedule for completing any additional work resulting from this broader definition. Resolution of issues will necessitate discussion and agreement between EM and the Office of Science SLAC National Accelerator Laboratory.

Interdependencies

DOE's lease with Stanford University requires "leaving the premises in a safe, clean and neat condition. When protection of groundwater and residential land use standards for accessible areas is achieved and upon project completion, EM will transition to the Office of Science all responsibility for environmental management of the SLAC National Accelerator Laboratory. EM may seek cooperation from the Office of Science to assume responsibility for any new project scope associated with the new Board Order. New scope might include additional or expanded reports required to satisfy the new Board Order. The Research Yard and Tritium Operable Units are the responsibility of Science to complete and, additionally, are not impacted by the revision in our order.

Contract Synopsis

The SLAC National Accelerator Laboratory is operated by Stanford University under contract with DOE. The term of Stanford University's lease with DOE will extend to 2012. The Management and Operating contract is being extended (negotiations are in progress) beyond its basic September 30, 2009, expiration. An Environmental Restoration Indefinite Delivery/Indefinite Quantity contractor was hired at the end of FY 2007 to perform most of the Environmental Cleanup activities.

Cleanup Benefits

Mitigating the existing environmental legacy risks at the SLAC National Accelerator Laboratory is paramount in maintaining Stanford University's positive visibility on the densely populated San Francisco Peninsula, where residential property values are among the highest nation-wide.

Tuba City

Tuba City, Arizona, is a Uranium Mill Tailing Removal Action site originally completed in 1990. The FY 2009 Omnibus Appropriation Act provided $5,000,000 for the purposes of carrying out remedial actions under the Uranium Mill Tailings Radiation Control Act of 1978 at real property in the vicinity of and immediately adjacent to the north-northwest section of the Tuba City processing site and on the north side of Highway 160. The proposed project included limited further radiological characterization of the site, development of a remedial action plan (likely to include excavation of contaminated soil and debris and transport to an approved disposal facility), site remediation and restoration, independent verification of cleanup, and closeout documentation.

Consolidated Business Center

The Consolidated Business Center assumed responsibility for administrative activities at EM non-defense sites in 2006, including contract closeout, litigation and litigation support. The EM non-defense facility closure project offices are not staffed to manage these activities, which are generally intermittent in nature and can be more consistently and effectively managed from a central location. The Consolidated Business Center is currently supporting active non-defense litigation at one former Uranium Mill Tailing Remediation Act site, as well as, supporting the determination and extent of Department cleanup responsibility at the former General Electric Vallecitos site, and beginning in FY 2009, site post-completion support at the Inhalation Toxicology Laboratory in New Mexico.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Non-Defense Environmental Cleanup			
Small Sites			
CBC-ND-0100 / CBC - Non-Defense Post Closure Administration and Program Support	1,100	1,200	0
BRNL-0100 / Brookhaven Community and Regulatory Support	0	179	300
BRNL-0030 / Soil and Water Remediation-Brookhaven National Laboratory	4,300	9,444	6,700
BRNL-0040 / Nuclear Facility D&D-Brookhaven Graphite Research Reactor	2,162	5,119	150
BRNL-0041 / Nuclear Facility D&D-High Flux Beam Reactor	1,971	258	6,711
CBC-CA-0100-N / Oakland Community and Regulatory Support (Non-Defense)	115	262	0
CBC-CA-0013B-N / Solid Waste Stabilization and Disposition-California Sites-2012 (Non-Defense)	72	0	0
CH-ANLE-0030 / Soil and Water Remediation-Argonne	500	0	0

	(dollars in thousands) FY 2009	 FY 2010	 FY 2011
National Laboratory-East			
CH-ANLE-0040 / Nuclear Facility D&D-Argonne National Laboratory-East	18,979	10,000	0
CBC-ETEC-0040 / Nuclear Facility D&D-Energy Technology Engineering Center	15,000	10,500	10,679
CBC-ITL-0030 / Soil and Water Remediation-Inhalation Toxicology Laboratory	272	0	0
CBC-MOAB-0031 / Soil and Water Remediation-Moab	40,699	39,000	31,000
CBC-TUBA-0031 / Soil and Water Remediation-Tuba City	5,000	0	0
CBC-SLAC-0030 / Soil and Water Remediation-Stanford Linear Accelerator Center	4,883	7,100	3,526
Subtotal, Small Sites	95,053	83,062	59,066
Total, Non-Defense Environmental Cleanup	95,053	83,062	59,066
Total, All Other Sites	95,053	83,062	59,066

Performance Measure Summary

	Complete through FY 2009	Complete through FY 2010	Complete through FY 2011	Life-Cycle	FY 2011 % Complete
All Other Sites					
Geographic Sites Eliminated (number of sites)	43	44	45	49	91.8%
Industrial Facility Completions (Number of Facilities)	25	25	25	27	92.6%
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	4,883	4,883	4,883	4,908	99.5%
Nuclear Facility Completions (Number of Facilities)	0	1	1	1	100.0%
Radioactive Facility Completions (Number of Facilities)	92	93	93	97	95.9%
Remediation Complete (Number of Release Sites)	782	797	816	826	98.8%
Spent Nuclear Fuel packaged for final disposition (Metric Tons of Heavy Metal)	1	1	1	1	100.0%
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	30	0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	22	0%

Detailed Justification

	(dollars in thousands) FY 2009	 FY 2010	 FY 2011
CH-ANLE-0030 / Soil and Water Remediation-Argonne National Laboratory-East	**500**	**0**	**0**

(dollars in thousands)

FY 2009	FY 2010	FY 2011

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This PBS involves investigation and remedial activities to reduce risk to human health and the environment at the release sites and thus comply with corrective action requirements of the Resource Conservation and Recovery Act Part B permit issued by the Illinois Environmental Protection Agency.

In FY 2011, the following activities are planned:

- No activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	443	443	443	443	100.0%

	FY 2009	FY 2010	FY 2011
CH-ANLE-0040 / Nuclear Facility D&D-Argonne National Laboratory-East	**18,979**	**10,000**	**0**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

Historic operations at Argonne National Laboratory focused on research reactor construction and operation, including nuclear support facilities such as glove boxes and hot cells. All the reactors are shut down as are most support facilities. Surplus contaminated facilities need to be decontaminated and in one case demolished, to reduce risk and support the overall Argonne National Laboratory mission of continuing science research and development work.

In FY 2011, the following activities are planned:

- No planned activities in FY 2011; the scope of work typically covered in this PBS is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Transuranic Waste shipped for disposal (Cubic meters) - CH	0	0	0	30	0%
Transuranic Waste shipped for disposal (Cubic meters) - RH	0	0	0	22	0%
Nuclear Facility Completions (Number of Facilities)	0	0	0	0	100.0%
Radioactive Facility Completions (Number of Facilities)	78	78	78	80	98.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- All Cells Ready For Demolition (FY 2009)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
BRNL-0030 / Soil and Water Remediation-Brookhaven National Laboratory	**4,300**	**9,444**	**6,700**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This PBS scope includes actions taken on environmental media and some building structures that became contaminated with radioactive and chemical substances at Brookhaven National Laboratory. Cleanup is conducted as a response action in accordance with the Comprehensive Environmental Response, Compensation and Liability Act and under an Interagency Agreement which serves as the Federal Facility Agreement among the DOE, the United States Environmental Protection Agency and New York State. DOE has committed to plan and implement an effective monitoring and treatment system operating program at the Laboratory. The end-state of this PBS is operation of sixteen groundwater treatment systems, completion of all required non-reactor facility decontamination and decommissioning, and soil and Peconic River cleanup (completed by September 30, 2005). Continuing activities such as groundwater monitoring and treatment system operations and maintenance are underway. The end state for this project was successfully achieved. All soil cleanups, tank removals, landfill caps and remediation of the Peconic River have been completed and all related wastes have been disposed of off-site. All sixteen groundwater treatment systems are either currently operating, or have completed their mission and have been shut down and/or decommissioned.

In FY 2011, the following activities are planned:

- Operation, maintenance of groundwater treatment plants located on and off site.
- Monitor existing on site landfills.
- Accumulate data from hundreds of monitoring wells (on and off site), and provide results on all activities to the regulatory and public community.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Radioactive Facility Completions (Number of Facilities)	3	3	3	3	100.0%
Remediation Complete (Number of Release Sites)	75	75	75	75	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Long-term soil and groundwater operations and environmental stewardship completion (FY 2009/September 2010/September 2011)

	FY 2009	FY 2010	FY 2011
BRNL-0040 / Nuclear Facility D&D-Brookhaven Graphite Research Reactor	**2,162**	**5,119**	**150**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This PBS scope includes characterization, stabilization, and decontamination and decommissioning of the Brookhaven Graphite Research Reactor at Brookhaven National Laboratory. The decommissioning of Brookhaven Graphite Research Reactor is conducted as a response action under the Comprehensive Environmental Response, Compensation and Liability Act. It is identified as Area of Concern 9 under an Interagency Agreement, which serves as the Federal Facility Agreement among the DOE, the United States Environmental Protection Agency and New York State. A Feasibility Study was prepared to evaluate viable decommissioning alternatives. DOE will maintain the facility in a protected state until the radioactivity naturally decays to low levels. As such, surveillance and maintenance of the remaining structures will be transferred to the Brookhaven National Laboratory landlord (DOE Office of Science) at project completion. Completed decommissioning work includes demolition and disposal of pile fans and sump, above-grade canal house, water treatment houses, instrument house, above-grade ducts, below-grade duct filters/coolers/liners (partial), below-grade piping to/from the canal, below-grade portions of the canal external to building 701, and selected hot pockets of contaminated soil.

Currently, the following actions have also been completed: pile sealed; building 701 isolated from Building 703; and temporary cap put in place until final decommissioning is complete; completed facility characterization, development of Documented Safety Analysis and Technical Safety Requirement documents for a needed upgrade to the facility Authorization Basis documents.

Remaining work includes removal of the graphite pile and bioshield as well as installation of an engineered cap.

In FY 2011, the following activities are planned:

- Install monitoring well and transition to long-term storage.
- Monitoring facilities environment set for long-term storage as well as addressing maintenance activities.
- Complete repairs as result of routine inspections.
- Dispose of waste resulting from maintenance and repairs.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Nuclear Facility Completions (Number of Facilities)	0	1	1	1	100.0%
Radioactive Facility Completions (Number of Facilities)	7	8	8	8	100.0%
Remediation Complete (Number of Release Sites)	1	1	1	1	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete DOE ORR (FY 2009)
- Continue packaging/shipping/disposal of waste generated by the demolition of the reactor bioshield. (July 2010)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Install groundwater monitoring wells. (August 2010)
- Regulatory Approval of Brookhaven Graphite Research Reactor D&D Project Closeout Report (December 2010)
- Complete Brookhaven Graphite Research Reactor Physical Project (December 2010)
- CD-4 Approval (March 2011)
- Complete Brookhaven Graphite Research Reactor Surveillance and Maintenance and all EM efforts transition to Office of Science (September 2011)

	FY 2009	FY 2010	FY 2011
BRNL-0041 / Nuclear Facility D&D-High Flux Beam Reactor	**1,971**	**258**	**6,711**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This PBS scope includes characterization, decontamination and decommissioning of the High Flux Beam Reactor at Brookhaven National Laboratory. The scope also includes the remediation of a two-acre plot of contaminated soil alongside a railroad spur. The High Flux Beam Reactor complex has been deactivated and stabilized. Fuel has been removed, equipment used to support research and experimentation has been removed, and the primary system, including the fuel pool, has been drained. Ancillary buildings have been demolished. Excess control rod blades and other legacy waste have been removed and disposed.

In FY 2011, the following activities are planned:

- Monitoring facilities environment set for long term storage as well as addressing maintenance activities.
- Decontamination and decommissioning of the High Flux Beam Reactor ancillary facilities/utilities in preparation of long term storage and working toward the completion of "legacy scope" at the Brookhaven National Laboratory.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	1	1	1	1	100.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Complete waste loading area remediation (FY 2009)
- Regulator Approval of High-Flux Beam Reactor Closeout Report. (March 2010)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Complete High-Flux Beam Reactor Building 750 Stabilization (March 2010) Complete D&D stack (March 2011) Complete High-Flux Beam Reactor Physical Project (September 2011)			

	FY 2009	FY 2010	FY 2011
BRNL-0100 / Brookhaven Community and Regulatory Support	**0**	**179**	**300**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

Brookhaven National Laboratory is listed on the National Priorities List. This PBS scope includes assistance to New York State for carrying out its oversight responsibilities in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act and the Federal Facility Agreement, also known as, the Brookhaven Interagency Agreement among the DOE, the United States Environmental Protection Agency, and the New York State Department of Environmental Conservation.

In FY 2011, the following activities are planned:

- Continued support by the New York Department of Environmental Conservation through a grant providing cleanup oversight at the Brookhaven National Laboratory.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) The New York State Department of Environmental Conservation will continue oversight of the Brookhaven Graphite Research Reactor decontamination and decommissioning and progress in groundwater cleanup with continued operation of the groundwater treatment systems. * (FY 2009/September 2010)					

	FY 2009	FY 2010	FY 2011
CBC-CA-0013B-N / Solid Waste Stabilization and Disposition-California Sites-2012 (Non-Defense)	**72**	**0**	**0**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The scope of work within this PBS includes management of similar activities for waste management and environmental restoration at multiple Non-Defense sites in California. Services for site investigations, hydrogeologic studies, regulatory review, and stakeholder liaisons are also included within this project.

In FY 2011, the following activities are planned:

- No activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete

Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	83	83	83	83	100.0%

CBC-CA-0100-N / Oakland Community and Regulatory Support (Non-Defense) 115 262 0

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This project provided funding for grants to State of California regulatory agencies for their oversight of environmental remediation at DOE sites, whether Comprehensive Environmental Response, Compensation, and Liability Act or Resource Conservation and Recovery Act driven.

In FY 2011, the following activities are planned:

- No activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Grants are paid annually to the State of California regulatory agencies (FY 2009)
- Regulators' annual cost reimbursement (FY 2009)

CBC-ND-0100 / CBC - Non-Defense Post Closure Administration and Program Support 1,100 1,200 0

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

Post-Closure Administration PBS provided funding support for post-closure contract liabilities such as ongoing site litigation support, contract closeouts, and worker's compensation for non-defense sites (i.e., Laboratory for Energy-Related Health Research, General Atomics, Title II Uranium Mill Tailing Remediation Act site, etc.).

In FY 2011, the following activities are planned:

- No activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- ITL Site: Transfer to the Office of Legacy Management. (October 2009)

	(dollars in thousands) FY 2009	FY 2010	FY 2011
CBC-ETEC-0040 / Nuclear Facility D&D-Energy Technology Engineering Center	**15,000**	**10,500**	**10,679**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The purpose of this PBS scope is to: 1) clean up contaminated release sites; 2) decontaminate and decommission radioactively and chemically contaminated facilities for eventual release to the Boeing Company (the site owner); 3) perform Resource Conservation and Recovery Act cleanup involving the remediation of both contaminated groundwater and soil; and 4) remove radioactive and hazardous waste from the site applying (when possible) waste minimization principles such as recycling. Currently, all decontamination and decommissioning is complete except for the Sodium Pump Test Facility, Building 4024, Hazardous Waste Management Facility, and the Radioactive Materials Handling Facility complex. Soil and groundwater characterization is being performed.

The end-state is to complete cleanup for both radiological contamination and chemical contamination. The site will then be turned over to the Boeing Company, which owns the land.

In FY 2011, the following activities are planned:

- Continue Resource Conservation and Recovery Act facility investigation program for soils and groundwater including sampling, analysis, and report preparations.
- Continue preparation of required supporting information for completion of a court ordered Environmental Impact Statement.
- Perform ongoing program support and landlord activities.
- Perform annual groundwater monitoring and site-wide environmental monitoring.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	1,055	1,055	1,055	1,080	98.0%
Radioactive Facility Completions (Number of Facilities)	4	4	4	6	67.0%
Industrial Facility Completions (Number of Facilities)	24	24	24	26	92.0%
Remediation Complete (Number of Release Sites)	4	4	4	14	29.0%

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Continue development of Environmental Impact Statement. (FY 2009)

CBC-ITL-0030 / Soil and Water Remediation-Inhalation Toxicology Laboratory

	FY 2009	FY 2010	FY 2011
CBC-ITL-0030 / Soil and Water Remediation-Inhalation Toxicology Laboratory	**272**	**0**	**0**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

Remedial activities for contaminated soil and groundwater at the site were completed in 1997. The EM Project was completed in FY 2009. In FY 2011, the site post-closure administration responsibilities, including recording keeping and administrative closure, will be transferred to the Office of Legacy Management.

In FY 2011, the following activities are planned:

- Project completion in FY 2009, no activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Low-Level and Mixed Low-Level Waste disposed (Cubic meters)	359	359	359	359	100.0%
Remediation Complete (Number of Release Sites)	9	9	9	9	100.0%

CBC-MOAB-0031 / Soil and Water Remediation-Moab

	FY 2009	FY 2010	FY 2011
CBC-MOAB-0031 / Soil and Water Remediation-Moab	**40,699**	**39,000**	**31,000**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

The project scope is to remediate contaminated mill tailings, mill debris, contaminated ground water, and contaminated vicinity properties at the former Atlas Minerals Corporation uranium ore-processing site. DOE became responsible for this mission upon enactment of the Floyd D. Spence National Defense Authorization Act of 2001. A Record of Decision issued in September 2005 required relocation of the mill tailings away from the Colorado River to a DOE-constructed disposal facility near Crescent Junction, Utah, primarily via rail transportation. The site is of particular public interest due to its unique setting on the banks of the Colorado River and its proximity to Arches National Park.

In FY 2011, the following activities are planned:

- Moab and Crescent Junction sites operations and maintenance.
- Continue operating interim remedial action for contaminated groundwater.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Continue placing tailings into the disposal cell and constructing the cell cover.
- Continue tailings excavation and transport from millsite to the disposal cell.
- Perform operations and maintenance of the materials handling system and infrastructure.
- Continue remediating vicinity properties in the community surrounding the tailings pile.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Start Cane Creek Rail Road upgrade. (FY 2009)
- Complete Moab site materials handling infrastructure (FY 2009)
- EVMS certification review (FY 2009)
- Complete Crescent Junction Rail Infrastructure (FY 2009)
- Complete Moab rail infrastructure (FY 2009)
- Start Mill Tailings Haul (FY 2009)
- Complete Cane Creek Branch Line rail upgrades (FY 2009)
- Complete Cane Creek Branch Line road crossing upgrades (FY 2009)
- Haul 215,000 tons of tailings (FY 2009)
- Recover 30 million gallons of contaminated ground water (November 2009)
- Transport 1.6 million tons of tailings to the disposal cell (September 2011)

CBC-SLAC-0030 / Soil and Water Remediation-Stanford Linear Accelerator Center **4,883** **7,100** **3,526**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

Activities in this PBS involve the cleanup of legacy contamination resulting from the physics research mission and operations over the past several decades at the SLAC National Accelerator Laboratory. The EM mission includes the identification of chemical contaminants in soil and groundwater and developing and implementing remedies to address these environmental concerns using Comprehensive Environmental Response, Compensation, and Liability Act technical guidance in accordance with the

Order. The principal contaminants of concern include polychlorinated biphenyls, lead, and volatile organic compounds in soils and groundwater. Preliminary Site Assessments have identified 54 release sites requiring further action; either further risk evaluation or remediation.

In FY 2011, the following activities are planned:

- Operate installed groundwater treatment systems and maintain compliance with Board Order.
- Complete installation of groundwater wells and treatment system.
- Complete residual remedial excavation and disposal for all West SLAC National Accelerator Laboratory sites and achieve closure certification.
- A portion of the scope of work typically covered in this PBS is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Remediation Complete (Number of Release Sites)	17	32	51	51	100.0%
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)					
▪ Complete Lower Salvage Yard Removal Action (FY 2009)					

CBC-TUBA-0031 / Soil and Water Remediation-Tuba City **5,000** **0** **0**

This PBS can be found within the Non-Defense Environmental Cleanup appropriation.

This project scope presents the basis for a schedule for the United States Department of Energy, Office of Environmental Management to remediate property located near the Tuba City, Arizona, disposal site that may contain residual radioactive material. The Tuba City disposal site is a former Uranium Mill Tailings Remedial Action project site.

In FY 2011, the following activities are planned:

- No activities planned.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Total, All Other Sites **95,053** **83,062** **59,066**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Non-Defense Environmental Cleanup	
Small Sites	
Argonne National Laboratory	
CH-ANLE-0040 / Nuclear Facility D&D-Argonne National Laboratory-East	
▪ In October 2010, all EM legacy cleanup work was completed; therefore, no funding was requested for FY 2011. In FY 2010, EM received $10,000,000 from the National Nuclear Security Administration for cleanup efforts.	-10,000
Brookhaven National Laboratory	
BRNL-0030 / Soil and Water Remediation-Brookhaven National Laboratory	
▪ Decrease reflects completion of remediation of contaminated soil at Building 96 Source Area and remediation of contaminated groundwater at the Sr-90 Plume.	-2,744
BRNL-0040 / Nuclear Facility D&D-Brookhaven Graphite Research Reactor	
▪ Decrease reflects transition to long-term surveillance and monitoring.	-4,969
BRNL-0041 / Nuclear Facility D&D-High Flux Beam Reactor	
▪ Increase reflects accelerated cleanup in order to work toward closeout of legacy scope.	6,453
BRNL-0100 / Brookhaven Community and Regulatory Support	
▪ No significant change.	121
California Site Support	
CBC-CA-0100-N / Oakland Community and Regulatory Support (Non-Defense)	
▪ No significant change.	-262
Completed Sites/Program Support	
CBC-ND-0100 / CBC - Non-Defense Post Closure Administration and Program Support	
▪ No significant change.	-1,200
Energy Technology Engineering Center	
CBC-ETEC-0040 / Nuclear Facility D&D-Energy Technology Engineering Center	
▪ Decrease reflects completion of the congressionally mandated radiological background study and the Area IV radiological characterization study.	179

	FY 2011 vs. FY 2010 ($000)
Moab	
CBC-MOAB-0031 / Soil and Water Remediation-Moab	
▪ Decrease reflects scope of work that is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview and an increase of efficiency of operations.	-8,000
SLAC National Accelerator Laboratory	
CBC-SLAC-0030 / Soil and Water Remediation-Stanford Linear Accelerator Center	
▪ Decrease reflects scope of work that is being executed with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.	-3,574
Total, All Other Sites	**-23,996**

Headquarters Operations

Funding by Site

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Congressionally Directed Projects	22,665	0	4,000	0
Headquarters	43,930	68,950	34,000	25,143
Total, Headquarters Operations	66,595	68,950	38,000	25,143

Description

The Headquarters Operations program includes policy, management and technical support activities to provide management and direction for various crosscutting EM and DOE initiatives. Through this program, EM establishes and implements national and departmental policies, provides focused technical expertise to resolve barriers to site cleanup, and conducts analyses and integrates activities across the DOE complex. The activities provide the policy basis and foundation for sites to complete their mission. The activities also identify opportunities that may result in cost savings. Also included is the Uranium/Thorium Reimbursement program that provides reimbursements to licensees (subject to a site-specific limit) for the cost of environmental cleanup of uranium and thorium processing contamination attributable to materials sold to the Government.

Benefits

As the EM cleanup progresses, the risk and hazard to human health and the environment is greatly reduced. In addition, as cleanup is completed and sites are closed, the financial resources needed to maintain site infrastructure will no longer be required. The integration, policy management, crosscutting and other activities funded by this account ensures that EM's primary cleanup mission and other DOE objectives proceed in a consistent, responsible and efficient manner.

American Recovery and Reinvestment Act Activities

The UED&D Title X Uranium/Thorium Reimbursement Program American Reinvestment and Recovery activities are funded at $68,950,000. Specifically, this funding will allow DOE to comply with Congressional direction to reimburse cleanup costs to companies that formerly processed uranium and thorium for sale to the Federal Government. The Title X Uranium/Thorium Reimbursement Program reimburses licensees, of certain Uranium and Thorium processing sites, for their portion of cleanup costs attributable to the production and sales of Uranium and Thorium to the Federal Government during the Cold War Era. Specifically, funding provided by the Recovery Act will be used to reimburse all eligible outstanding claims owed to eleven licensees. Cleanup generally consists of the demolition and disposal of mills that processed Uranium and Thorium ores; consolidation and capping of Uranium and Thorium mill tailings (process waste) in disposal cells; and the cleanup and treatment of groundwater. This funding will enable the licensees of these sites to accelerate the completion of their cleanup programs and the elimination of associated environmental risks at the sites.

Mercury Export Ban Act of 2008

The Mercury Export Ban Act of 2008 bans the export of elemental mercury generated in the United States beginning in 2013, prohibits federal agencies from either selling or distributing mercury, and instructs DOE to provide long-term management and storage for elemental mercury. The facility needs to be operational by January 1, 2013. Additionally, DOE's mercury storage operations will be subject to the requirements of the Solid Waste Disposal Act, the Resource Conservation and Recovery Act, and the National Environmental Policy Act. In addition, DOE was required to issue guidance outlining procedures and standards for the operation of the long-term elemental mercury management and storage facility no later than October 1, 2009. DOE issued these procedures and standards guidance in November 2009. By October 1, 2012, DOE shall disclose fee amounts that will be collected at the time of mercury delivery to the management and storage facility. As soon as the designated facility is operational, DOE is required to transmit a report to Congress each year on costs incurred; this action will be completed no later than 60 days after the end of each Federal fiscal year. Finally, DOE is required to transmit to Congress a Mercury Recycling Study by July 1, 2014.

DOE began preparation of an Environmental Impact Statement in May 2009 to identify a long-term elemental mercury management and storage facility. The total cost of these two documents is estimated at $5M, of which $3.3M was funded in FY 2009, with the balance of $1.7M to be funded in FY 2010.

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Program Support			
Headquarters			
HQ-MS-0100 / Policy, Management, and Technical Support	33,930	34,000	25,143
Congressionally Directed Projects			
Headquarters			
HQ-CDP-0100 / Congressionally Directed Projects	17,908	4,000	0
Total, Defense Environmental Cleanup	51,838	38,000	25,143
Non-Defense Environmental Cleanup			
Congressionally Directed Projects			
Headquarters			
HQ-CDP-0100-N / Non-Defense Congressionally Directed Projects	4,757	0	0

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Uranium Enrichment Decontamination and Decommissioning Fund			
U/Th Reimbursements			
Headquarters			
HQ-UR-0100 / Reimbursements to Uranium/Thorium Licensees	10,000	0	0
Total, Headquarters Operations	66,595	38,000	25,143

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
HQ-MS-0100 / Policy, Management, and Technical Support	**33,930**	**34,000**	**25,143**

This PBS can be found within the Defense Environmental Cleanup appropriation.

This PBS scope includes management and direction for various crosscutting EM and DOE initiatives, establishment and implementation of national and departmental policies, various intergovernmental activities, and analyses and integration activities across the DOE complex. Also, the scope of this PBS includes government-furnished services and items necessary to accelerate site cleanup and risk reduction efforts, assure pathways to disposition waste and materials, conduct transportation, packaging, and emergency preparedness activities, complete necessary policy analyses, support legal claims, support closure assistance activities, and effectively communicate with the public and stakeholders regarding the EM program's activities. It includes the National Environmental Policy Act analysis on Greater-Than-Class C radioactive waste disposal, as required by Section 631 of the Energy Policy Act of 2005.

In FY 2011, the following activities are planned:

- Continue support of Tribal, State, and local government participation through the State and Tribal Government Working Group, local officials exchange seminars, government-to-government interactions with the Native American Tribes and grants with the National Governors Association.
- Provide expertise in the areas of safety, health and security, emergency management, package certification, quality assurance, nuclear criticality safety, and risk management.
- Instill safety awareness by utilizing the National Safety Council to conduct surveys which will indicate whether and how EM's commitment to safety is working.
- Issue the final Environmental Impact Statement for Disposal of Greater-Than-Class C Radioactive Waste.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Support various Secretarial and Departmental initiatives, including the Defense Contracts Audit Agency audits, Government Industry Data Exchange Program and Consolidated Accounting Investment System.
- Provide support to various advisory groups such as the Nuclear Regulatory Commission, National Academy of Sciences and Low-Level Radioactive Waste Forum, to obtain technical assistance and expertise that indirectly supports EM mission objectives.
- Administer the EM and DOE-wide transportation and packaging responsibilities and the Transportation Emergency Preparedness Program.
- Provide rapid response from technical experts or "External/Internal" review teams to address emerging, imminent technical issues impeding site cleanup and closure.
- Provide technical solution projects designed to reduce near-term technical risks and technical assistance to include site troubleshooting, consulting, scientific or technical problem solving.
- Complete Mercury Export Ban Environmental Impact Statement, develop the fee amounts for long-term elemental mercury management and storage, and begin planning activities for the facility.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
HQ-CDP-0100 / Congressionally Directed Projects	**17,908**	**4,000**	**0**

This PBS can be found within the Defense Environmental Cleanup appropriation.

The FY 2009 Omnibus Appropriation included six congressionally directed projects within the Office of Environmental Management.

	FY 2009	FY 2010	FY 2011
▪ Characteristics and Clean-up of U.S. Nuclear Legacy (MS)	3,806	4,000	0
▪ Miamisburg Mound, OU-1 (OH)	4,757	0	0
▪ Testing of Polymeric Hydrogels for Radiation Decontamination (HI)	1,618	0	0
▪ The International Alternative Clean-up Technology Agreement (PA)	2,854	0	0

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
▪ Water Resources Data, Modeling, and Visualization Center (NV)	1,067	0	0
▪ WIPP Records Archive (NM)	3,806	0	0
Total, Congressionally Direct Projects	17,908	4,000	0

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

HQ-CDP-0100-N / Non-Defense Congressionally Directed Projects	**4,757**	**0**	**0**

This PBS can be found within the Non-Defense Environmental Cleanup Projects.

The FY 2009 Omnibus Appropriation included three congressionally directed projects within the Office of Environmental Management.

▪ Bioinformatics and Computational Biology Initiative (KY)	951	0	0
▪ Southwest Experimental Fast Oxide Reactor Decommissioning (AR)	1,903	0	0
▪ Western Environmental Technology Office (MT)	1,903	0	0
Total, Congressionally Direct Projects	4,757	0	0

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
HQ-UR-0100 / Reimbursements to Uranium/Thorium Licensees	**10,000**	**0**	**0**

This PBS can be found within the Uranium Enrichment Decontamination and Decommissioning Fund appropriation.

Pursuant to Title X of the Energy Policy Act of 1992 and 10 CFR Part 765, this PBS scope includes reimbursements to fourteen active uranium and thorium processing site licensees for their portion of environmental cleanup costs attributable to nuclear materials sold to the Federal Government. Of these fourteen, only eleven licensees are eligible for continued Federal reimbursement. The total estimated maximum future liability for the program is approximately $240,000,000 in unescalated dollars. This is based on the completed review and approval of licensees' Plans for Subsequent Remedial Action (required per a provision in the Energy Policy Act). The cost estimate in each approved Plan for Subsequent Remedial Action is the maximum amount in constant dollars that a licensee may claim for reimbursement.

As of September 2009, DOE has reimbursed the thirteen uranium licensees $272,121,000 and the thorium licensee $333,145,000 for an aggregate reimbursement amount of $605,266,000.

In FY 2011, the following activities are planned:

- No planned activities in FY 2011; the payments typically provided under this PBS are being provided with ARRA funding as discussed above in the American Recovery and Reinvestment Act Activities section of the Site Overview.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Total, Headquarters Operations	**66,595**	**38,000**	**25,143**

Title X of the Energy Policy Act of 1992: Uranium/Thorium Reimbursement Program Status of Payments through Fiscal Year 2009 and Estimated Maximum Program Liability ($ Thousands)

Licensees	Total Payments FY 1994-FY 2009	Approved but Unpaid Claim Balances After FY 2009 Payments (Costs for Uranium Licensees that Exceed Current Dry Short Ton Ceiling)	Maximum Remaining Program Liability Including Estimated Costs in Approved Plans for Subsequent Remedial Action
Uranium			
American Nuclear Corp. Site			
American Nuclear Corporation................	820	0	0
State of Wyoming................................	1,269	0	758
Atlantic Richfield Company[a].........................	32,306	0	0
Atlas Corporation/Moab Mill Reclamation Trust[a]....	9,694	0	0
Cotter Corporation......................................	2,987	423	3,340
Dawn Mining Company................................	7,897	0	10,545
Homestake Mining Company........................	47,337	0	88,029
Pathfinder Mines Corporation........................	10,722	0	327
Petrotomics Company[a]..............................	2,850	0	0
Rio Algom Mining LLC[b]	35,245	0	12,313
Tennessee Valley Authority..........................	15,410	9,720	9,720
Umetco Minerals Corporation-CO..................	54,064	19,145	34,420
Umetco Minerals Corporation-WY..................	19,943	3,735	6,683
Western Nuclear, Incorporated.....................	31,575	0	1,926
Subtotal, Uranium......................................	272,121	33,023	168,061

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[a] Reimbursements have been completed to the Atlantic Richfield Company, the licensees of the Moab site and the Petromics Company.

[b] Formerly Quivira Mining Company.

Licensees	Total Payments FY 1994-FY 2009	Approved but Unpaid Claim Balances After FY 2009 Payments (Costs for Uranium Licensees that Exceed Current Dry Short Ton Ceiling)	Maximum Remaining Program Liability Including Estimated Costs in Approved Plans for Subsequent Remedial Action
Thorium			
Tronox LLC[c]	333,145	0	70,840
Subtotal, Thorium	333,145	0	70,840
Total, Uranium and Thorium	605,266	33,023	238,901

[c] Formerly Kerr-McGee Chemical Corp.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Congressionally Directed Projects	
Headquarters	
HQ-CDP-0100 / Congressionally Directed Projects	
▪ No funding requested.	-4,000
Program Support	
HQ-MS-0100 / Policy, Management, and Technical Support	
▪ Reduction reflects reduced requirements for various environmental impact statement activities and secretarial initiatives.	-8,857
Total, Headquarters Operations	**-12,857**

Program Direction

Funding Profile by Category

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Carlsbad			
Salaries and Benefits	6,018	7,000	7,315
Travel	393	450	179
Other Related Expenses	411	689	534
Total, Carlsbad	6,822	8,139	8,028
Full Time Equivalents	45	50	50
Idaho			
Salaries and Benefits	9,449	9,880	10,324
Travel	285	285	200
Support Services	287	39	0
Other Related Expenses	319	330	252
Total, Idaho	10,340	10,534	10,776
Full Time Equivalents	69	70	70
Oak Ridge			
Salaries and Benefits	11,077	11,907	12,443
Travel	212	218	225
Support Services	2,642	2,984	1,115
Other Related Expenses	2,827	2,827	2,827
Total, Oak Ridge	16,758	17,936	16,610
Full Time Equivalents	80	82	82
Portsmouth/Paducah Project Office			
Salaries and Benefits	6,817	7,147	7,469
Travel	355	325	350
Support Services	1,198	1,300	1,040
Other Related Expenses	1,520	520	92
Total, Portsmouth/Paducah Project Office	9,890	9,292	8,951
Full Time Equivalents	47	48	48
Richland			
Salaries and Benefits	36,077	38,171	39,889
Travel	681	768	531
Support Services	936	704	486
Other Related Expenses	7,347	6,188	4,276
Total, Richland	45,041	45,831	45,182
Full Time Equivalents	264	275	275
River Protection			
Salaries and Benefits	20,012	20,792	21,728
Travel	669	638	341
Support Services	2,875	2,660	2,000
Other Related Expenses	2,127	2,369	1,575
Total, River Protection	25,683	26,459	25,644
Full Time Equivalents	134	145	145

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Savannah River			
Salaries and Benefits	43,462	46,355	48,441
Travel	714	933	789
Support Services	1,809	1,723	1,797
Other Related Expenses	3,244	6,058	3,436
Total, Savannah River	49,229	55,069	54,463
Full Time Equivalents	331	345	345
Small Sites			
Salaries and Benefits	4,400	4,634	4,843
Travel	424	426	250
Support Services	1,226	1,999	1,380
Other Related Expenses	1,200	1,466	1,058
Total, Small Sites	7,250	8,525	7,531
Full Time Equivalents	32	32	32
Nevada Site Office			
Salaries and Benefits	3,242	3,440	3,595
Travel	83	94	38
Support Services	695	355	278
Other Related Expenses	85	39	21
Total, Nevada Site Office	4,105	3,928	3,932
Full Time Equivalents	24	25	25
NNSA Sites			
Salaries and Benefits	4,227	4,012	4,193
Travel	255	277	191
Support Services	837	1,676	1,080
Other Related Expenses	663	1,148	871
Total, NNSA Sites	5,982	7,113	6,335
Full Time Equivalents	32	28	28
EM Career Development Corp			
Salaries and Benefits	3,906	3,200	3,344
Travel	600	797	551
Other Related Expenses	235	197	136
Total, EM Career Development Corp	4,741	4,194	4,031
Full Time Equivalents	39	40	40
Field			
Salaries and Benefits	148,687	156,538	163,584
Travel	4,671	5,211	3,645
Support Services	12,505	13,440	9,176
Other Related Expenses	19,978	21,831	15,078
Total, Field	185,841	197,020	191,483
Full Time Equivalents	1,097	1,140	1,140
Headquarters Operations			
Salaries and Benefits	53,889	59,315	61,984
Travel	3,568	3,503	2,421
Support Services	11,744	29,466	20,361
Other Related Expenses	26,123	25,879	17,894
Total, Headquarters Operations	95,324	118,163	102,660
Full Time Equivalents	329	344	344

	(dollars in thousands/whole FTEs)		
	FY 2009	FY 2010	FY 2011
Consolidated Business Center			
Salaries and Benefits	23,594	25,645	26,799
Travel	1,235	1,100	500
Support Services	274	1,500	83
Other Related Expenses	3,539	1,572	2,300
Total, Consolidated Business Center	28,642	29,817	29,682
Full Time Equivalents	175	190	190
Environmental Management			
Salaries and Benefits	226,170	241,498	252,367
Travel	9,474	9,814	6,566
Support Services	24,523	44,406	29,620
Other Related Expenses	49,640	49,282	35,272
Total, Environmental Management	309,807	345,000	323,825
Full Time Equivalents	1,601	1,674	1,674

Mission

Program Direction provides for the Federal workforce responsible for the overall direction and administrative support of the EM program, including both Headquarters and field personnel. The EM mission of safe, risk reduction and cleanup of the nuclear weapons environmental legacy is carried out by a workforce composed largely of contractors, although there are a variety of functions that are inherently governmental (e.g., program management, contract administration, budget formulation and execution, and interagency and international coordination) that require a dedicated Federal workforce.

The role of the Headquarters Federal workforce is to provide leadership, establish and implement policy, conduct analyses, and integrate activities across sites. Increasing standards of accountability for program performance and spending require Headquarters staff to closely analyze budget requests, track expenditures, and compile congressionally mandated and other program plans (e.g., footprint reduction goals). Field personnel are responsible and directly accountable for implementing the EM program within the framework established by Headquarters policy and guidance. In addition, the field is responsible for the day-to-day oversight and project management of the Department's facilities, the facility contractors and other support contractors, as well as construction and test activities that support EM activities for DOE.

Environmental Management Professional Development

EM will continue aggressive recruitment efforts to seek qualified personnel. Therefore, the EM Professional Development Corps (previously EM Career Intern Program) will be institutionalized to provide a means for succession planning and ensuring a continuing source of highly competent technical personnel with the skills and knowledge to meet EM's current and future technical staffing needs. The program began in FY 2007 with the hiring of 20 individuals. It is anticipated that a steady pipeline of 40 individuals will be participating in the program at any one time. Upon successful completion of the career development program, these individuals will be eligible for non-competitive conversion to permanent career conditional or career status.

National Academy of Public Administration Recommendations

In December 2007 the National Academy of Public Administration published a report on the Environmental Management program which included recommendations on Human Capital. Specifically, the Academy "urged the Department to increase EM's staffing allocation by at least 200 over the currently budgeted levels." EM leadership collectively agreed that the recommended FTE ceiling increases were necessary to address our mission needs and began an aggressive campaign to improve recruitment strategies and address the Academy recommendation. EM has successfully recruited and retained more than 200 people since the release of the Academy report.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**226,170**	**241,498**	**252,367**

Provides funding for 1,674 full-time equivalent employees in FY 2011 with the responsibility for the overall direction and administrative support of the EM program, including Headquarters (344 employees based in Germantown, Maryland and Washington, DC), field personnel (1,100 employees at Operations/Field/Sites Offices located throughout the United States), the EM Consolidated Business Center (190 employees in Cincinnati, Ohio), and the recruitment of 40 employees associated with the EM Professional Development Corps. The federal workforce performs a variety of functions that are inherently governmental such as project management, program management, contract management and administration, budget formulation and execution, and interagency and international coordination. In addition, funding is provided for workers' compensation payments to the Department of Labor, transit subsidies and incentive awards.

	FY 2009	FY 2010	FY 2011
Travel	**9,474**	**9,814**	**6,566**

The FY 2011 estimate includes all costs of transportation of persons, subsistence of travelers, incidental travel expenses, as well as funding to support permanent change of duty station in accordance with Federal travel regulations that are directly chargeable to EM. In addition, travel costs associated with the continuation of the EM Professional Development Corps to support rotational assignments at EM sites, training, and participation at university sponsored career fairs, professional conferences and special interest/emphasis conferences for recruitment purposes are provided. Travel expenses for the certifications associated with Federal Project Directors and Procurement Specialists are also included.

	FY 2009	FY 2010	FY 2011
Support Services	**24,523**	**44,406**	**29,620**

Provides technical and administrative support for cost effective, short-term and intermittent requirements not available within the Federal workforce. Support services include but are not limited to technical and administrative support, program management and integration, management information and support systems, performance systems, and cost/schedule studies. Program management includes support for organizational and strategic planning; coordination and interaction with other Federal, State

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

and local government agencies and private industrial concerns; performance measurement; and cost assessment.

Technical support services include feasibility of design considerations; development of specifications, system definition, system review and reliability analyses; trade-off analyses; economic and environmental analyses which may be used in DOE's preparation of environmental impact statements; and test and evaluation, surveys or reviews to improve the effectiveness, efficiency and economy of technical operations.

Management support services include analyses of workload and work flow; directives management studies; automated data processing; manpower systems analyses; assistance in the preparation of program plans; training and education; analyses of Departmental management processes; and any other reports or analyses directed toward improving the effectiveness, efficiency and economy of management and general administrative services.

	FY 2009	FY 2010	FY 2011
Other Related Expenses	**49,640**	**49,282**	**35,272**

Provides for the physical and administrative support to the Federal workforce at both Headquarters and the field. The level of support provided by EM varies at each site depending on EM's role in relation to other Departmental programs. Examples of the type of support that may be provided include training, rents and utilities, supplies, printing, maintenance and repair of government vehicles and equipment; maintenance and renovations of buildings; janitorial and custodial services; transit operations (shuttle bus); alarm protection systems; and other vendor services, including those associated with contractual services (storage of household goods and the buying/selling of homes) in conjunction with directed permanent change of duty station. Also includes funding to support core curriculum formal classroom training as well as recruitment incentives such as Student Loan Reimbursement for the EM Professional Development Corps.

A Working Capital Fund established at Headquarters to which EM contributes, allocates the costs of common administrative services to the recipient Headquarters organizations. Activities supported by the Working Capital Fund include automated office support, telephone services, postage, printing and graphics, supplies, building occupancy, payroll processing, contract closeouts, corporate training services, Project Management Career Development Program, the Standard Accounting and Reporting System, shuttle bus, logistics support services contract, Strategic Integrated Procurement Enterprise System, and On-line Learning Center. This category also includes the cost of training the Federal workforce, and the Corporate Asset Management and Capital Planning and Investment Control (CPIC) Information Technology Project Management Training. Significant portions of these expenditures are fixed in nature and do not change in relation to the workforce.

	FY 2009	FY 2010	FY 2011
Total, Program Direction	**309,807**	**345,000**	**323,825**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits	
▪ Increase reflects government-wide 4.5 percent escalation for pay and personnel-related costs for 1674 full-time equivalent employees.	10,869
Travel	
▪ Decrease reflects the return on information technology investments such as video conference capabilities.	-3,248
Support Services	
▪ Decrease reflects the shift of responsibilities from contractors to the more than 200 federal staff recently added to the EM workforce.	-14,786
Other Related Expenses	
▪ Decrease reflects EM's on-going efforts to maximize the usage of uncosted carryover and reduce non-payroll-related expenses.	-14,010
Total Funding Change, Program Direction	**-21,175**

Support Services by Category

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Technical Support Services			
Feasibility of Design Considerations	3,560	5,249	5,547
Development of Specifications	0	0	0
System Definition	551	116	0
System Review and Realiability Analyses	0	0	0
Trade-Off Analyses	0	0	0
Economic and Environmental Analysis	4,259	7,879	6,033
Test and Evaluation Studies	96	104	77
Surveys or Reviews of Technical Operations	6,097	12,213	5,646
Total, Technical Support Services	14,563	25,561	17,303
Management Support Services			
Analyses of Workload and Work Flow	0	0	0
Directives Management Studies	687	2,668	1,127
Automatic Data Processing	1,311	2,541	2,582
Manpower Systems Analyses	0	0	0
Preparation of Program Plans	0	0	0
Training and Education	177	273	294
Analysis of DOE Management Processes	637	987	640
Reports and Analyses Management and General Administrative Support	7,148	12,376	7,674
Total, Management Support Services	9,960	18,845	12,317
Total, Support Services	24,523	44,406	29,620

Other Related Expenses by Category

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Rent to GSA	7,416	8,931	11,165
Rent to Others	1,213	1,268	1,532
Communication, Utilities, Misc.	6,873	8,131	4,590
Printing and Reproduction	222	72	0
Other Services	11,572	9,590	5,503
Training	900	215	229
Purchases from Gov. Accounts	1,376	186	129
Operation and Maintenance of Equipment	1,709	1,865	1,262
Supplies and Materials	240	199	105
Equipment	2,230	3,032	1,969
Working Capital Fund	15,889	15,793	8,788
Total, Other Related Expenses	49,640	49,282	35,272

Safeguards and Security

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Safeguards and Security			
CB-0020 / Safeguards and Security	5,124	4,644	4,755
OH-WV-0020 / Safeguards and Security-West Valley	2,800	1,859	1,926
OR-0020 / Safeguards and Security	27,020	32,400	17,300
PA-0020 / Safeguards and Security	8,196	8,190	8,496
PO-0020 / Safeguards and Security	4,500	17,509	15,979
RL-0020 / Safeguards and Security	79,765	82,771	69,234
SR-0020 / Safeguards and Security	138,736	132,064	132,064
Subtotal, Safeguards and Security	266,141	279,437	249,754

Description

The Environmental Management safeguards and security program ensures appropriate levels of protection against unauthorized access, theft, diversion, loss of custody or destruction of DOE assets and hostile acts that may cause adverse impacts on fundamental national security or the health and safety of DOE and contractor employees, the public or the environment.

The Environmental Management protected assets include large quantities of nuclear and special nuclear materials, millions of classified documents, classified technology, and specialized equipment as well as more than 950 square miles of government owned land and hundreds of major nuclear and non-nuclear facilities at seven sites across the country. Nearly 27,000 DOE-EM contractor employees work at these sites which are protected by over 1,800 security personnel including nearly 1,500 protective force personnel. The majority of the budget covers salaries and benefits of the security personnel along with the weapons, ammunition, vehicles, training, vulnerability assessments, and computer modeling required to keep them in an operational mode.

Benefits

EM's landlord sites include the Savannah River Site[a], the Hanford Site (including the Office of River Protection), Carlsbad/Waste Isolation Pilot Plant, West Valley Demonstration Project, East Tennessee Technology Park, Paducah Gaseous Diffusion Plant, and the Portsmouth Gaseous Diffusion Plant.

These sites are secured by multiple layers of security measures. Each site has a security plan or a site safeguards and security plan and a cyber security plan addressing the protection programs for DOE interests including: classified information, nuclear weapons components, and special nuclear materials. In addition, personnel security programs ensure the continued reliability of employees having access to classified matter and special nuclear material at all EM sites.

Since the events of September 11, 2001, the Department revised the Design Basis Threat several times to define the protection capabilities of security programs, particularly for Category I special nuclear material, throughout the complex. During this period, EM made significant strides consolidating its special nuclear material, to include reducing its Category I facilities to one each at the Hanford Site and the Savannah River Site. Despite these significant consolidations, EM safeguards and security costs continue to be assessed to identify additional efficiencies in implementing the recently promulgated Graded Security Protection policy.

The following is a brief description of the type of activities performed to fulfill EM's safeguards and security responsibilities:

Protective Forces

Protective forces are an integral part of the security program designed to protect EM assets, including special nuclear material, classified and sensitive information, and other EM interests. Protective forces are a significant cost driver of the safeguards and security program and EM managers promote the use of new technologies which may reduce reliance on protective forces and associated costs. Protective forces provide response capabilities to interrupt, deny, contain, and neutralize any adversarial actions against Departmental assets.

Transportation

EM ensures security (including safe havens) for both inter- and intra-site transfers of special nuclear material and other classified and/or nuclear material. Domestic off-site special nuclear material shipments are made by the Office of Secure Transportation. The Office of Secure Transportation is authorized under 42 U.S.C to carry firearms and make arrests without warrant and is charged with the responsibility of safely and securely transporting and/or escorting nuclear devices, nuclear components, and sensitive nuclear materials. The courier is authorized under 10 CFR 1047.7(a)(3) and (4) to use deadly force to protect certain items. Special nuclear material is transported in packages and containers designed to contain radioactivity for health and safety purposes; the safety design provides inherent physical security protection, i.e., delay. These packages and containers for special nuclear material are also sealed with tamper indicating devices.

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[a] The tritium facilities are under the purview of the National Nuclear Security Administration.

Physical Security Systems

Category I and II quantities of special nuclear material are protected by an integrated physical protection system including access controls, barriers or delay mechanisms and intrusion detection systems annunciating locally as well as at central alarm stations.

- Access (ingress and egress) controls ensure that only appropriately cleared and authorized personnel are permitted access to special nuclear material and classified matter.
- Delay mechanisms are used to deter and delay access, removal, or unauthorized use of Category I and II quantities of special nuclear material. Delay mechanisms may include both passive physical barriers (e.g., walls, ceilings, floors, windows, doors, and security bars) and activated barriers (e.g., sticky foam, pop-up barriers, and cold smoke). Active and/or passive denial systems are employed at select target locations, as appropriate, to reduce reliance on protective forces.
- Security systems provide intrusion detection as required by DOE orders. Detection measures such as sensors or alarms, and closed-circuit televisions are used to protect classified matter and special nuclear material. Additional security measures include: explosive detection, and other inspection procedures.

Physical security systems are periodically tested according to the approved site performance testing plan to ensure system effectiveness.

Information Security

Information Security provides information protection, classification and declassification of classified and sensitive unclassified information, critical infrastructure which includes alarm systems and automated process control systems, technical security countermeasures and operations security.

Personnel Security

Access authorizations are granted in accordance with DOE Manual 470.4-5, *Personnel Security*. Personnel Security encompasses the processes for administrative determination that an individual is eligible for access to classified matter, or is eligible for access to, or control over, special nuclear material. Personnel Security also includes security education and awareness programs for DOE federal and contractor employees and processing and hosting approved foreign visitors under United States and DOE initiatives. Security investigation activities performed by the Federal Bureau of Investigation and the Office of Personnel Management associated with access authorizations are funded in their entirety in FY 2011 by each EM site. Prior to FY 2010, the Office of Security has funded field access authorization personnel security investigations with incremental funding provided by EM sites where additional security investigations were required above the base-level.

Material Control and Accountability

Material Control and Accountability programs are designed to deter and detect theft and diversion of nuclear material by both outside and inside adversaries. The level of control and accountability are graded based on the consequences of their loss. Material Control and Accountability programs address both the theft and diversion of special nuclear material or materials that can be used to make an improvised nuclear device.

Program Management

Safeguards and Security Program Management coordinates the management of Physical Protection, Protective Force, Information Security, Personnel Security, and Material Control and Accountability to achieve and ensure appropriate levels of protection against unauthorized access, theft, diversion, loss of custody or destruction of DOE assets and hostile acts that may cause adverse impacts on fundamental national security or the health and safety of DOE and contractor employees, the public or the environment.

Appropriate levels of security are achieved by integrating site strategic and near-term operational planning with complex-wide requirements, in addition to the applicable laws, regulations, treaties, state, and local commitments. Foreign visits and assignments, safety, emergency management, and intelligence and counterintelligence programs are also addressed under Safeguards and Security Program Management. Program Management provides policy oversight and administration, planning, training, and development for the site's overall security program.

Cyber Security

EM Cyber Security provides protection for the processing, storing, and transmission of unclassified and classified computer/telecommunications information, processes, methods, and tools that support certification and accreditation of secure and sensitive enterprise networks, to ensure that all DOE unclassified and classified information resources are identified and protected in a manner consistent with the site's mission and possible threats. In the last few years, the Department has seen an increase in the amount and sophistication of cyber attacks. In addition, the Office of Management and Budget has mandated additional steps and processes aimed at enhancing the security of information systems and at enhancing the protection of sensitive personally identifiable information.

In response to Office of Inspector General findings, EM has implemented a Cyber Security assessment program to ensure that EM field sites are providing appropriate cyber security based on sound risk management principles and is monitoring site progress in resolving identified weaknesses during the certification and accreditation process mandated under the Federal Information Security Management Act and Office of Management and Budget directives. Through the assessment program, EM independently verifies and validates the effectiveness of mandatory controls and performs a discovery process to determine if additional weaknesses are present and not identified by the site self assessment process.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
CB-0020 / Safeguards and Security	**5,124**	**4,644**	**4,755**

The Waste Isolation Pilot Plant in Carlsbad, New Mexico, is the nation's only mined geologic repository for the permanent disposal of defense-generated transuranic waste. The scope of the Security Program at the Waste Isolation Pilot Plant includes, but is not limited to, planning, administering, and executing a program that protects government assets.

In FY 2011, the following activities are planned:

- Maintain adequate security coverage at the Waste Isolation Pilot Plant.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Maintain Security Posture (FY 2009/September 2010/September 2011)					

	FY 2009	FY 2010	FY 2011
OH-WV-0020 / Safeguards and Security-West Valley	**2,800**	**1,859**	**1,926**

The Safeguards and Security Program at the West Valley Demonstration Project includes those activities required to provide physical and cyber security for all project activities in accordance with applicable DOE standards. The West Valley Demonstration Project Safeguards and Security Program provides a secure working environment during execution of the Project by maintaining access controls and perimeter security of the site, and ensuring general site security for personnel and information technology systems.

This scope will continue until DOE's mission at the West Valley Demonstration Project is complete.

In FY 2011, the following activities are planned:

- Provide physical and cyber security by an on-site guard force to ensure all DOE information resources are identified and protected at all times.
- Continue program management to oversee the security program including training and qualifications for the West Valley Demonstration Project.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Continue to support Project activities by providing physical security and protection, cyber security, visitor control, personnel security, and program management. (FY 2009/September 2010/September 2011)					

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
OR-0020 / Safeguards and Security	**27,020**	**32,400**	**17,300**

The East Tennessee Technology Park's Safeguards and Security Program is comprised of the following eight program elements: Protective Force, Security Systems, Information Security, Cyber Security, Personnel Security, Security Investigations, Nuclear Material Control and Accountability, and Program Management. The integration of these eight security elements provides stability and reliability to the overall security posture at the East Tennessee Technology Park.

The Safeguards and Security Program at the East Tennessee Technology Park continues to work towards the initial completion of Homeland Security Presidential Directive-12, which directed the Federal Government to transition to new identification credentials.

In FY 2011, the following activities are planned:

- Maintain DOE required security for the following major facilities: K-25, K-27, K-1037, Centrifuge Facilities, Classified Burial Grounds, Environmental Management Waste Management Facility, and Transuranic Waste Processing Facility.

- Security protection provided for enriched uranium, transuranic material, classified components, equipment and work performed under the American Recovery and Reinvestment Act.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Implement Safeguards and Security Program to project against loss or theft of classified matter or Special Nuclear Material (FY 2009/September 2010/September 2011)					

	FY 2009	FY 2010	FY 2011
PA-0020 / Safeguards and Security	**8,196**	**8,190**	**8,496**

This project provides: visitor control, classification, personnel security, physical security (locks/alarms, access control), information security, implementation of the new Graded Security Protection policy (formerly the Design Basis Threat), Nuclear Material Control and Accountability, operations security, technical surveillance countermeasures, Safeguards and Security Awareness Program, foreign national visits/assignments management, a security management control system, classified computer security, personnel security, and review of incidents and infractions (many of which involve legacy issues with decontamination, decommissioning, and demolition and DOE Material Storage Areas projects) for DOE and its contractors at the Paducah Gaseous Diffusion Plant.

Protective Force personnel are employed on various fixed and mobile posts to perform normal and emergency security tasks. Classification and operations security review of all documents released to the public including Freedom of Information Act and Privacy Act requests, litigation responses, and ongoing environmental health investigations, and classify/declassify documents. Oversight and

(dollars in thousands)

FY 2009	FY 2010	FY 2011

management of Nuclear Material Control and Accountability activities are provided. Personnel security provides badging/clearance support for all employees, contractors, and visitors and visitor control.

In FY 2011, the following activities are planned:

- Provide security services for personnel, equipment, information, matter, and special nuclear materials relating to DOE missions, to include decommissioning, decontamination, and demolition activities.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					
Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011) ▪ Ensure that no unauthorized person or persons will gain access to the site and that all sensitive material is safeguarded (FY 2009/September 2010/September 2011)					

PO-0020 / Safeguards and Security **4,500** **17,509** **15,979**

This PBS provides an integrated Safeguards and Security Program which includes the following program elements: protective forces; physical security systems to include sub-elements barrier/secure storage/locks and entry control and access controls; information security including information protection, classification/declassification, technical surveillance countermeasures, and operations security; Personnel security including clearance program, security awareness, and visit control; Material Control and Accountability; program management which includes planning, professional training and development, and policy oversight and administration; and cyber security including classified computer security and communications security.

Protective Force personnel are employed on various fixed and mobile posts to perform normal and emergency security tasks. Information security includes protection of classified and unclassified sensitive information and classification, declassification and review of documents for release to the public including Freedom of Information Act and Privacy Act requests, and a limited number of litigation responses. Cyber Security includes the maintenance of one stand-alone desktop computer approved for classified processing. Oversight and management of Nuclear Material Control and Accountability activities is provided. Personnel Security provides processing access authorizations, security education and awareness and badging support.

In FY 2011, the following activities are planned:

- Maintain the appropriate level of safeguards and security using a graded approach for the non-leased portions of the Portsmouth Gaseous Diffusion Plant.

- Provide Protective Forces, Nuclear Material Control and Accountability and communications security services.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Maintain appropriate levels of safeguards and security. (FY 2009/September 2010/September 2011)

RL-0020 / Safeguards and Security **79,765** **82,771** **69,234**

The Safeguards and Security Program ensures appropriate levels of protection for the Hanford Site facilities against theft or diversion of special nuclear material; acts of radiological sabotage; espionage; theft or loss of classified matter; protection of sensitive information; theft or loss of government property; and other hostile acts that may cause unacceptable impacts on national security, or the health and safety of employees, the public, or the environment.

FY 2009 and FY 2010 funding included life-cycle and efficiency improvements for safeguards and security equipment, facilities, and weapons to support site activities and protective force defenses of the newly established protected area at the Canister Storage Building complex within the 200-East Area. This new protected area provides secure storage for nuclear materials pending disposition, allowed the closure of the Plutonium Finishing Plant protected area, and enables the accelerated decontamination and decommissioning of the Plutonium Finishing Plant complex. The new protected area became fully operational in the first quarter of FY 2010.

In FY 2011, the following activities are planned:

- Maintain appropriate Hanford site access controls, emergency response, and physical security at the Hanford Site, including protection of spent fuels and nuclear materials at the Canister Storage Building complex protected area.
- Maintain Material Control and Accountability, Information Security, Personnel Security, and Protective Force at all Hanford operations.
- Maintain information security, to include cyber security, programs for the protection of classified matter.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Implement security upgrades to Canister Storage Building (FY 2009)
- De-activate the Plutonium Finishing Plant's protected area (March 2010)
- Maintain appropriate Hanford site access controls, emergency response, and

(dollars in thousands)

FY 2009	FY 2010	FY 2011

physical security (September 2010/September 2011)

- Complete ~ $7.7M of critical infrastructure/life-cycle one time upgrades (September 2010)

SR-0020 / Safeguards and Security	**138,736**	**132,064**	**132,064**

The DOE-Savannah River Office of Safeguards, Security, and Emergency Services oversees and manages, safeguards, security and emergency service activities at the Savannah River Site. This organization formulates and executes policies and programs in the areas of physical, information, and personnel security; classification and declassification; cyber security; technical surveillance countermeasures; foreign visits and assignments; protective force; and Material Control and Accountability. These various programs are implemented by Savannah River Nuclear Solutions (the M&O contractor) and WSI – Savannah River Site (the protective force contractor).

The Savannah River Site Safeguards and Security Program employs a number of methods to ensure appropriate levels of protection against unauthorized access, theft, diversion, loss of custody or destruction of DOE assets and hostile acts that may cause adverse impacts on fundamental national security or the health and safety of DOE and contractor employees, the public or the environment. The Savannah River Site is required to ensure the security of the special nuclear material which it currently stores and processes.

In FY 2011, the following activities are planned:

- Operate and maintain the materials control and accountability program for special nuclear material.
- Maintain appropriate uniformed protective force personnel to assure the security of special nuclear materials, facilities, and other site assets.
- Operate and maintain physical security protection systems.
- Ensure protection of classified and unclassified computer security.
- Execute information and operational security measures, cyber security, personnel security and program management for the Savannah River Operations Office.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
Material Access Areas eliminated (Number of Material Access Areas)	2	2	2	3	+67.0%

Key Accomplishments (FY 2009)/Planned Milestones (FY 2010/FY 2011)

- Ensure timely and accurate material control and accountability for nuclear materials at the Savannah River Site (FY 2009/September 2010/September 2011)
- Ensure no theft of nuclear material takes place at the Savannah River Site (FY 2009/September 2010/September 2011)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
■ Ensure that no unauthorized person or persons will gain access to limited areas within the Site perimeter (FY 2009/September 2010/September 2011) ■ Complete Graded Security Protection Policy implementation (September 2010)			
Total, Safeguards and Security	**266,141**	**279,437**	**249,754**

Funding Schedule by Site and Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Carlsbad			
Protective Forces	4,649	4,214	4,314
Information Security	211	191	196
Program Management	202	183	188
Subtotal, Carlsbad	5,062	4,588	4,698
Cyber Security	62	56	57
Total, Carlsbad	5,124	4,644	4,755
Oak Ridge			
Protective Forces	19,627	23,492	9,104
Physical Security Systems	1,910	1,974	1,935
Information Security	983	1,021	981
Personnel Security	688	73	76
Security Investigations	0	1,643	1,669
Material Control and Accountability	1,562	1,943	1,349
Program Management	885	885	817
Subtotal, Oak Ridge	25,655	31,031	15,931
Cyber Security	1,365	1,369	1,369
Total, Oak Ridge	27,020	32,400	17,300
Paducah			
Protective Forces	4,797	4,791	4,970
Physical Security Systems	781	781	810
Information Security	1,174	1,174	1,218
Personnel Security	246	0	0
Security Investigations	0	246	255
Material Control and Accountability	618	618	641
Program Management	580	580	602
Total, Paducah	8,196	8,190	8,496
Portsmouth			
Protective Forces	1,957	8,199	6,951
Physical Security Systems	230	843	818
Information Security	481	1,761	1,707
Personnel Security	118	0	0
Security Investigations	0	431	418

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Material Control and Accountability	123	450	436
Program Management	794	4,925	4,659
Subtotal, Portsmouth	3,703	16,609	14,989
Cyber Security	797	900	990
Total, Portsmouth	4,500	17,509	15,979
Richland			
Protective Forces	37,590	46,048	41,096
Physical Security Systems	12,303	11,288	6,779
Information Security	607	912	601
Personnel Security	2,085	2,441	2,203
Security Investigations	0	900	50
Material Control and Accountability	1,887	2,808	1,874
Program Management	23,028	16,260	14,668
Subtotal, Richland	77,500	80,657	67,271
Cyber Security	2,265	2,114	1,963
Total, Richland	79,765	82,771	69,234
Savannah River			
Protective Forces	94,443	87,816	89,471
Physical Security Systems	11,372	11,640	12,450
Information Security	2,596	2,511	2,096
Personnel Security	7,412	3,958	7,091
Security Investigations	0	3,500	350
Material Control and Accountability	5,790	5,919	5,885
Program Management	12,368	12,226	9,197
Transportation	839	654	335
Subtotal, Savannah River	134,820	128,224	126,875
Cyber Security	3,916	3,840	5,189
Total, Savannah River	138,736	132,064	132,064
West Valley Demonstration Project			
Protective Forces	900	1,049	1,137
Program Management	250	359	347
Subtotal, West Valley Demonstration Project	1,150	1,408	1,484
Cyber Security	1,650	451	442
Total, West Valley Demonstration Project	2,800	1,859	1,926
Total, Safeguards and Security	266,141	279,437	249,754

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Protective Forces	163,963	175,609	157,043
Physical Security Systems	26,596	26,526	22,792
Information Security	6,052	7,570	6,799
Personnel Security	10,549	6,472	9,370
Security Investigations	0	6,720	2,742
Material Control and Accountability	9,980	11,738	10,185
Program Management	38,107	35,418	30,478
Transportation	839	654	335
Subtotal, Safeguards and Security	256,086	270,707	239,744
Cyber Security	10,055	8,730	10,010
Safeguards and Security	266,141	279,437	249,754

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Safeguards and Security	
CB-0020 / Safeguards and Security	
▪ Not a significant change.	111
OH-WV-0020 / Safeguards and Security-West Valley	
▪ Not a significant change.	67
OR-0020 / Safeguards and Security	
▪ The decrease at Oak Ridge reflects the use of projected carryover from FY 2010 to maintain the necessary level of security services.	-15,100
PA-0020 / Safeguards and Security	
▪ Not a significant change.	306
PO-0020 / Safeguards and Security	
▪ The decrease at Portsmouth reflects the completion in FY 2010 of updating facilities to provide for a classified document storage area and classified conference room.	-1,530
RL-0020 / Safeguards and Security	
▪ The decrease at Richland is due to off-site plutonium de-inventory completion and associated closure of the Plutonium Finishing Plant protected area and the completion of upgrades for Safeguards and Security life-cycle cost reductions, permitting a reduction in site protective force requirements.	-13,537
Total, Safeguards and Security	**-29,683**

Capital Operating Expenses

	(dollars in thousands) FY 2009	FY 2010	FY 2011
General Plant Projects	12,303	11,288	6,779

Technology Development and Deployment

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Technology Development and Deployment			
Research and Development to Reduce Technical Risk	31,415	19,440	28,960
Small Business Innovative Research Program	0	560	3,360
Total, Technology Development and Deployment	31,415[a]	20,000	32,320[b]

Description

This program can be found within the Defense Environmental Cleanup appropriation. The scope of this program includes direct support of cleanup initiatives and opportunities for transformational technologies associated with environmental management. The program currently focuses on the highest risk and cost projects for the EM complex by addressing issues related to: Tank Waste, Spent Nuclear Fuel, Soil and Groundwater cleanup, and Deactivation and Decommissioning of contaminated excess facilities including nuclear reactors and chemical separation plants. The proposed program is fully aligned with the findings and the recommendations of the National Research Council's March 2, 2009, report entitled "Advice on the Department of Energy's Cleanup Technology Roadmap: Gaps and Bridges" which highlights the need for investment in the development of break-through technologies.

Benefits

The Technology Development and Deployment program provides key investments in mid- and long-range research and development projects focused on enabling, facilitating, and accelerating high priority cleanup issues. These research and development projects are aimed at improving the technical maturity for current baseline technologies, developing cost-effective transformational alternative technologies, and improving or providing next-generation technologies for insertion into program projects. The results of this research and development will address technology gaps and reduce technical uncertainty in the EM program.

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[a] FY 2009, $905,000 ($808,000 for Small Business Innovation Research and $97,000 for Small Business Technical Transfer Programs) transferred to the Office of Science for award and administration of grants to small businesses.

[b] Includes Small Business Innovative Research requirement associated with research and development activities at various sites across the EM complex.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Research and Development to Reduce Technical Risk	**31,415**	**19,440**	**28,960**
Small Business Innovative Research Program	**0**	**560**	**3,360**

Funding for the Small Business Innovative Research assessment is in accordance with Public Law 102-564, which mandates a percentage of all research and development dollars be set aside for grants to small businesses. Once funding is appropriated, it is transferred to the DOE Office of Science for award and administration of grants to small businesses.

In FY 2009, $905,000 ($808,000 for Small Business Innovation Research and $97,000 for Small Business Technical Transfer Programs) was transferred to the Office of Science for award and administration of grants to small businesses. The FY 2010 and FY 2011 amounts shown are estimated requirements for the continuation of the Small Business Innovation Research and Small Business Technical Transfer programs. The FY 2011 amount also includes the estimate associated with R&D activities at various sites across the EM complex.

	FY 2009	FY 2010	FY 2011
Total, Technology Development and Deployment	**31,415**	**20,000**	**32,320**

Planned Accomplishments (FY 2009)

Tank Waste

- Supported the development of technologies to improve the removal of waste from the waste tanks at Hanford and the Savannah River Site.
- Supported the development of technologies to treat the waste in the waste tanks at Hanford and the Savannah River Site.
- Developed a calcine stabilization technology, hot isostatic pressing, as a feasible option to stabilize calcine waste at Idaho.

Soil and Groundwater

- Supported enhanced sampling and characterization, including new tools for characterization of buried pipes and soils under buildings and slabs and test geophysical tools to develop site conceptual model for mercury remediation.
- Supported development of advanced transport and fate models to improve the ability to predict future plume movement and develop concepts for advanced predictive capabilities to provide input for development of next generation groundwater models.

Deactivation and Decommissioning

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Developed a "Deactivation and Decommissioning Toolbox" of technologies and approaches to reduce technical risks and uncertainty with future deactivation and decommissioning work scope at Oak Ridge and the Savannah River Site.

Planned Accomplishments (FY 2010)

Tank Waste

- Provide technologies at the Savannah River Site to understand structural vulnerability and chemical corrosion mechanisms in waste tanks to preserve tank integrity and enable enhanced capacity.
- Provide efficient retrieval technology at the Savannah River Site to remove the most difficult waste heels from waste tanks.
- Develop improved formulations and methods for using grout or other materials to stabilize residual tank waste and ancillary systems.
- Demonstrate fluidized bed steam reforming technology as an alternative supplemental treatment method for organic containing wastes.
- Develop low temperature treatment processes to immobilize volatile and semi-volatile radionuclides (e.g., cesium-137, technectium-99, and iodine-129).
- Improve glass formulation and demonstration of high aluminum containing glasses for the Defense Waste Processing Facility.

Spent Nuclear Fuel

- Initiate development of cost-effective, near real-time monitoring systems to determine fuel condition and cladding integrity.
- Determine aluminum Spent Nuclear Fuel corrosion mechanisms relative to variables in current storage environments.
- Technical justifications for and methodologies to extend the design life of DOE Spent Nuclear Fuel storage facilities.
- Evaluate systems to remove organic epoxy compounds from fuels to meet waste acceptance criteria.
- Develop the technical bases for drying the wide range of DOE fuels.
- Initiate development of a remotely operated welding system for the Standard Canister.

Soil and Groundwater

- Improve sampling and characterization at Oak Ridge to detect contamination under slabs and other buried infrastructure.
- Develop advanced site conceptual model techniques to enhance understanding of contaminant fate and transport to determine more effective remediation systems.

- Initiate development of predictive models that combine high performance computing with advanced physical and chemistry models to assist with design of effective and sustainable remediation strategies.
- Demonstrate enhanced attenuation technologies for metals and radionuclides stabilization and for

(dollars in thousands)

FY 2009	FY 2010	FY 2011

solvent contamination at the Savannah River Site.

Deactivation and Decommissioning

- Develop improved characterization technologies for highly radioactively contaminated facilities.
- Develop innovative technologies to support and enable the effective implementation of In-Situ Decommissioning (entombment) of highly contaminated facilities at Savannah River and Richland.
- Develop a first-of-a-kind sampling/characterization platform and instrumentation to enable remote characterization of highly contaminated off-gas stacks.
- Develop technology and approaches for in-situ decommissioning including characterization, containment/entombment, and continuous surveillance and monitoring.
- In collaboration with, and leveraging resources of the United Kingdom Nuclear Decommissioning Authority, complete proof of concept testing and deployment of a unique remote gamma characterization tool.

Planned Accomplishments (FY 2011)

Tank Waste

- Complete the initial tool set development for the modeling of cementitious materials performance in waste management applications; this will enable improved risk-informed decision-making, shorter analysis times, and improve transparency.
- Determine the effectiveness of using Gadolinium as a neutron poison for plutonium to support optimizing the plutonium loading in the Defense Waste Processing Facility glass thus reducing the number of Defense Waste Processing Facility canisters.
- Develop a common set of technical requirements to determine science-based technical approaches for particular tank retrieval tasks and to identify technology gaps and support technologies.
- Develop and demonstrate effective methods to optimize oxalic acid use during the chemical cleaning of tanks. While oxalic acid is an effective chemical cleaning agent, its use produces sodium oxalate, which increases the amount of waste to be processed and disposed.
- Develop the performance characteristics of Hot Isostatic Pressing as advanced processes for stabilization of challenging materials. Specifically, demonstrate the Hot Isostatic Pressing process and resulting waste form for the Hanford K Basin sludges. Assess the Hot Isostatic Pressing process as a viable disposition pathway for challenging materials.

Spent Nuclear Fuel

- Evaluate technologies for repackaging degraded fuels that are currently canned. This includes drying technologies and development of standardized inner packages.
- Develop procedures and standards for implementing technology developments relative to welding and neutron absorbers.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Soil and Groundwater

- Accelerate deployment of less aggressive and less costly attenuation based remedies for remediation through the development, in collaboration with regulatory groups, of a multiple scenarios decision-making tool.
- Quantify, through development of contaminant flux of analysis methods of organics and inorganics, extent of vadose zone contamination which will provide critical information enabling final selection of remediation approaches, including both active and passive methods.
- Develop a model for performance assessment of technically advanced and less costly foam based delivery systems to stabilize and treat contaminants in the deep vadose zone. Validate model through meso-scale testing of foam delivery systems for sequestration of dispersed metal and radionuclide contamination.
- Develop the architecture to host a fully integrated, high-performance subsurface computational modeling system that incorporates advanced high-performance computing technologies.
- Develop next generation technical models for computational modeling system that integrate subsurface flow and chemical transport and hydrological, geochemical, biological, and thermal processes.

Deactivation and Decommissioning

- Demonstrate a suite of technologies (e.g., the "smart tooling" system) for characterization and to facilitate deactivation and decommissioning of a contaminated off-gas stack at Oak Ridge.
- Initiate deactivation and decommissioning for In-Situ Decommissioning (entombment) at the Savannah River Site to demonstrate technology and approaches for characterization, containment, continuous surveillance and monitoring.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Research and Development to Reduce Technical Risk	
▪ Increase supports applied research and technology development to reduce technical uncertainty, to improve technical maturity, to improve work safety, and to reduce lifecycle costs and schedule. This increased investment will address gaps in the areas of tank waste, soil and groundwater remediation, and deactivation and decommissioning.	9,520
Small Business Innovative Research Program	
▪ Reflects an increase in funding for applied research and technology development. The funding is a mandated tax of 2.8 percent based on the total amount of extramural research and development funds. Also includes the tax associated with R&D activities at various sites across the EM complex.	2,800
Total, Technology Development and Deployment	**12,320**

Federal Contribution to the Uranium Enrichment Decontamination and Decommissioning Fund

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Defense Environmental Cleanup			
Federal Contribution to the Uranium Enrichment D&D Fund			
HQ-DD-0100 / Federal Contribution to the Uranium Enrichment D&D Fund	463,000	463,000	496,700

Overview

The Defense Environmental Cleanup, Federal Contribution to the Uranium Enrichment Decontamination and Decommissioning Fund, funds the Federal Government contribution to the Uranium Enrichment Decontamination and Decommissioning Fund, as required by the Energy Policy Act of 1992 (The Act). Prior to October 24, 2007, the Act authorized annual fund contributions which came from both a special assessment on domestic utilities and annual Congressional appropriations.

The Administration is proposing an amendment to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) to reinstate additional Federal deposits into the Fund for a period of 15 years. Total annual deposits from the Federal government shall not exceed $463,000,000 (to be adjusted for inflation in following years). In FY 2011 the deposit will be $496,700,000 to reflect a base contribution of $463,000,000 and a $33,700,000, which is the remaining obligation of the Federal government to the Fund under the Energy Policy Act of 1992. This proposal reiterates the ongoing need to decontaminate, decommission and remediate the uranium processing facilities, and the responsibility of the Federal government for these costs.

Benefits

This fund is responsible for maintaining, decontaminating, decommissioning, and remediating uranium processing facilities. This includes the environmental management responsibilities at the nation's three gaseous diffusion plants at Paducah, Kentucky, Portsmouth, Ohio, and Oak Ridge, Tennessee.

The account also provides funding for reimbursement of licensees operating uranium or thorium processing sites for the cost of environmental cleanup at those sites. The funding request for Uranium/Thorium is found in the Headquarters chapter of the budget.

As the cleanup and decommissioning at the gaseous diffusion plants progresses (as well as the cleanup at uranium/thorium processing sites), the risk and hazard to human health and the environment is greatly reduced. In addition, as cleanup is completed, the financial resources needed to maintain site infrastructure will be reduced.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
HQ-DD-0100 / Federal Contribution to the Uranium Enrichment D&D Fund	**463,000**	**463,000**	**496,700**

The Energy Policy Act of 1992 created the Uranium Enrichment Decontamination and Decommissioning Fund to pay for the cost of cleanup of the gaseous diffusion facilities located in Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. The purpose of this activity is to provide the annual Federal contribution to the Uranium Enrichment Decontamination and Decommissioning Fund to cover the costs of cleanup at the three gaseous diffusion plants. The increase in funding for this activity reflects the funding of the remainder of the government's obligation under the Energy Policy Act of 1992 in the amount of $33,700,000.

- Provide the FY 2011 Federal Government contribution to the Uranium Enrichment Decontamination and Decommissioning Fund, as required by the Energy Policy Act of 1992.

Metrics	Complete Through FY 2009	Complete Through FY 2010	Complete Through FY 2011	Life-cycle Quantity	FY 2011 % Complete
No metrics associated with this PBS					

	FY 2009	FY 2010	FY 2011
Total, D&D Fund Deposit	**463,000**	**463,000**	**496,700**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Defense Environmental Cleanup	
Federal Contribution to the Uranium Enrichment D&D Fund	
HQ-DD-0100 / Federal Contribution to the Uranium Enrichment D&D Fund	
▪ Increase in funding for this activity reflects the funding of the remainder of the government's obligation under the Energy Policy Act of 1992.	33,700
Total, D&D Fund Deposit	**33,700**

GENERAL PROVISIONS

[SEC. 301. None of the funds appropriated by this Act may be used to prepare or initiate Requests For Proposals (RFPs) for a program if the program has not been funded by Congress.]

[SEC. 302. None of the funds appropriated by this Act may be used—

(1) to augment the funds made available for obligation by this Act for severance payments and other benefits and community assistance grants under section 4604 of the Atomic Energy Defense Act (50 U.S.C. 2704) unless the Department of Energy submits a reprogramming request to the appropriate congressional committees; or

(2) to provide enhanced severance payments or other benefits for employees of the Department of Energy under such section; or

(3) develop or implement a workforce restructuring plan that covers employees of the Department of Energy.]

SEC. [303]*301*. The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. [304]*302*. None of the funds in this or any other Act for the Administrator of the Bonneville Power Administration may be used to enter into any agreement to perform energy efficiency services outside the legally defined Bonneville service territory, with the exception of services provided internationally, including services provided on a reimbursable basis, unless the Administrator certifies in advance that such services are not available from private sector businesses.

SEC. [305]*303*. When the Department of Energy makes a user facility available to universities or other potential users, or seeks input from universities or other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users. When the Department of Energy considers the participation of a university or other potential user as a formal partner in the establishment or operation of a user facility, the Department shall employ full and open competition in selecting such a partner. For purposes of this section, the term "user facility" includes, but is not limited to:

(1) a user facility as described in section 2203(a)(2) of the Energy Policy Act of 1992 (42 U.S.C. 13503(a)(2));

(2) a National Nuclear Security Administration Defense Programs Technology Deployment Center/User Facility; and

(3) any other Departmental facility designated by the Department as a user facility.

SEC. [306]*304*. Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 414) during fiscal year [2010] *2011* until the enactment of the Intelligence Authorization Act for fiscal year [2010] *2011*.

SEC. [307]*305*. Of the funds made available by the Department of Energy for activities at Government-owned, contractor-operated laboratories funded in this Act or subsequent Energy and

Water Development Appropriations Acts, the Secretary may authorize a specific amount, not to exceed 8 percent of such funds, to be used by such laboratories for laboratory directed research and development: *Provided*, That the Secretary may also authorize a specific amount not to exceed 4 percent of such funds, to be used by the plant manager of a covered nuclear weapons production plant or the manager of the Nevada Site Office for plant or site directed research and development.

SEC. [308]*306.* (a) In any fiscal year in which the Secretary of Energy determines that additional funds are needed to reimburse the costs of defined benefit pension plans for contractor employees, the Secretary may transfer not more than 1 percent from each appropriation made available in this and subsequent Energy and Water Development Appropriation Acts to any other appropriation available to the Secretary in the same Act for such reimbursements.

[(b) Where the Secretary recovers the costs of defined benefit pension plans for contractor employees through charges for the indirect costs of research and activities at facilities of the Department of Energy, if the indirect costs attributable to defined benefit pension plan costs in a fiscal year are more than charges in fiscal year 2008, the Secretary shall carry out a transfer of funds under this section.]

([c]*b*) In carrying out a transfer under this section, the Secretary shall use each appropriation made available to the Department in that fiscal year as a source or the transfer, and shall reduce each appropriation by an equal percentage, except that appropriations for which the Secretary determines there exists a need for additional funds for pension plan costs in that fiscal year, as well as appropriations made available for the Power Marketing Administrations, the title XVII loan guarantee program, and the Federal Energy Regulatory Commission, shall not be subject to this requirement.

([d]*c*) Each January, the Secretary shall report to the Committees on Appropriations of the House of Representatives and the Senate on the state of defined benefit pension plan liabilities in the Department for the preceding year.

([e]*d*) This transfer authority does not apply to supplemental appropriations, and is in addition to any other transfer authority provided in this or any other Act. The authority provided under this section shall expire on September 30, 2015.

([f]*e*) The Secretary shall notify the Committees on Appropriations of the House of Representatives and the Senate in writing not less than 30 days in advance of each transfer authorized by this section.

[SEC. 309. (a) Subject to subsection (b), no funds appropriated or otherwise made available by this Act or any other Act may be used to record transactions relating to the increase in borrowing authority or bonds outstanding at any time under the Federal Columbia River Transmission System Act (16 U.S.C. 838 et seq.) referred to in section 401 of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 140) under a funding account, subaccount, or fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol.

(b) Funds appropriated or otherwise made available by this Act or any other Act may be used to ensure, for purposes of meeting any applicable reporting provisions of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 115), that the Bonneville Power Administration uses a fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol solely to report accrued expenditures of projects attributed by the Administrator of the Bonneville Power Administration to the increased borrowing authority.

(c) This section is effective for fiscal year 2010 and subsequent fiscal years.]

[SEC. 310. Section 1702 of the Energy Policy Act of 2005 (42 U.S.C. 16512) is amended by adding at the end the following new subsection:

"(k) WAGE RATE REQUIREMENTS.—All laborers and mechanics employed by contractors and subcontractors in the performance of construction work financed in whole or in part by a loan guaranteed under this title shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards in this subsection, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code.".]

[SEC. 311. None of the funds made available by this Act may be used to make a grant allocation, discretionary grant award, discretionary contract award, Other Transaction Agreement, or to issue a letter of intent totaling in excess of $1,000,000, or to announce publicly the intention to make such an award, including a contract covered by the Federal Acquisition Regulation, unless the Secretary of Energy notifies the Committees on Appropriations of the Senate and the House of Representatives at least 3 full business days in advance of making such an award or issuing such a letter: *Provided*, That if the Secretary of the Department of Energy determines that compliance with this section would pose a substantial risk to human life, health, or safety, an award may be made without notification and the Committees on Appropriations of the Senate and the House of Representatives shall be notified not later than 5 full business days after such an award is made or letter issued.]

[SEC. 312. (a) ULTRA EFFICIENT VEHICLES.—Section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) is amended—
(1) in subsection (a)—
(A) in paragraph (1), by inserting "an ultra efficient vehicle or" after "means"; and
(B) by adding at the end the following new paragraph:
"(5) ULTRA EFFICIENT VEHICLE.—The term 'ultra efficient vehicle' means a fully closed compartment vehicle designed to carry at least 2 adult passengers that achieves—
"(A) at least 75 miles per gallon while operating on gasoline or diesel fuel;
"(B) at least 75 miles per gallon equivalent while operating as a hybrid electric-gasoline or electric-diesel vehicle; or
"(C) at least 75 miles per gallon equivalent while operating as a fully electric vehicle.";
(2) in subsection (b)—
(A) by inserting ", ultra efficient vehicle manufacturers," after "automobile manufacturers";
(B) in paragraph (1)—
(i) by striking "or" at the end of subparagraph (A);
(ii) by striking "and" at the end of subparagraph (B) and inserting "or"; and
(iii) by adding at the end the following new subparagraph:
"(C) ultra efficient vehicles; and"; and
(C) in paragraph (2), by inserting ", ultra efficient vehicles," after "qualifying vehicles";
(3) in subsection (g), by inserting "or are utilized primarily for the manufacture of ultra efficient vehicles" after "20 years"; and
(4) in subsection (h)(1)(B), by striking "automobiles" the first place it appears and inserting "ultra efficient vehicles, automobiles,".
(b) RECONSIDERATION OF PRIOR APPLICATIONS.—The Secretary of Energy shall reconsider applications for assistance under section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) that were—
(1) timely filed under that section before January 1, 2009;

(2) rejected on the basis that the vehicles to which the proposal related were not advanced technology vehicles; and

(3) related to ultra efficient vehicles.]

[SEC. 313. (a) Except as provided in subsection (b), none of the funds appropriated or otherwise made available by this title for the Strategic Petroleum Reserve may be made available to any person that as of the enactment of this Act—

(1) is selling refined petroleum products valued at $1,000,000 or more to the Islamic Republic of Iran;

(2) is engaged in an activity valued at $1,000,000 or more that could contribute to enhancing the ability of the Islamic Republic of Iran to import refined petroleum products, including—

(A) providing ships or shipping services to deliver refined petroleum products to the Islamic Republic of Iran;

(B) underwriting or otherwise providing insurance or reinsurance for such an activity; or

(C) financing or brokering such an activity; or

(3) is selling, leasing, or otherwise providing to the Islamic Republic of Iran any goods, services, or technology valued at $1,000,000 or more that could contribute to the maintenance or expansion of the capacity of the Islamic Republic of Iran to produce refined petroleum products.

(b) The prohibition on the use of funds under subsection (a) shall not apply with respect to any contract entered into by the United States Government before the date of the enactment of this Act.

(c) If the Secretary determines a person made ineligible by this section has ceased the activities enumerated in (a)(1)-(3), that person shall no longer be ineligible under this section.]

[SEC. 314. Section 132 of the Energy and Water Development Appropriations Act of 2006 (119 Stat 2261) is amended—

(1) in subsection (a)(3), by striking "Corps of Engineers" and inserting "Southwestern Power Administration";

(2) by adding at the end of subsection (a) the following new paragraph:

"(5) PAYMENT TO NON-FEDERAL LICENSEE.—Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 pursuant to paragraph (3) using receipts collected from the sale of Federal power and energy related services. Pursuant to paragraph (6), Southwestern Power Administration will begin collecting receipts in the Special Receipts and Disbursement account upon the date of enactment of this paragraph. Payment to the licensee of Federal Energy Regulatory Commission Project No. 2221 shall be paid as soon as adequate receipts are collected in the Special Receipts and Disbursement Account to fully compensate the licensee, and in accordance with paragraph (2), such payment shall be considered non-reimbursable.";

(3) by adding at the end of subsection (a) the following new paragraph:

"(6) The Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 in annual payments of not less than $5,000,000, until the licensee of Federal Energy Regulatory Commission Project No. 2221 is fully compensated pursuant to paragraph (3). At the end of each fiscal year subsequent to implementation, any remaining balance to be paid to the licensee of Project No. 2221 shall accrue interest at the 30-year U.S. Treasury bond rate in effect at the time of implementation of the White River Minimum Flows project.";

(4) by adding at the end of subsection (a) the following new paragraph:

"(7) ESTABLISHMENT OF SPECIAL RECEIPT AND DISBURSEMENT ACCOUNTS.—There is established in the Treasury of the United States a special receipt account and corresponding disbursement account to be made available to the Administrator of the Southwestern Power Administration to disburse pre-collected receipts from the sale of federal power and energy and related services. The accounts are authorized for the following uses:

"(A) Collect and disburse receipts for purchase power and wheeling expenses incurred by Southwestern Power Administration to purchase replacement power and energy as a result of implementation of the White River Minimum Flows project.

"(B) Collect and disburse receipts related to compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221.

"(C) Said special receipt and disbursement account shall remain available for not more than 12 months after the date of full compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221."; and

(5) by adding at the end of subsection (a) the following new paragraph:

"(8) TIME OF IMPLEMENTATION.—For purposes of paragraphs (3) and (4), 'time of implementation' shall mean the authorization of the special receipt account and corresponding disbursement account described in paragraph (7).".]

SEC. 307. (a) Section 1801 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g) is amended in subsection (b)(2) by striking "amounts contained within the Fund" and inserting "assessments collected pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) as amended".

(b) Section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) is amended:

(1) in subsection (a):

(A) by striking *"$518,233,333" and inserting "$663,000,000"; and*

(B) by striking *"on October 24, 1992" and inserting "with fiscal year 2012".*

(2) in subsection (c):

(A) by inserting *"(1)" before "The Secretary";*

(B) by inserting *after "utilities": ", only to the extent provided in advance in appropriation Acts";*

(C) by striking "$150,000,000" and inserting "$200,000,000";

(D) by inserting *"beginning in fiscal year 2012" after "adjusted for inflation";*

(E) by striking "(1)" and inserting "(A)";

(F) by striking "(2)" and inserting "(B)";

(G) by adding a new paragraph 2, ",(2) Amounts authorized to be collected pursuant to this section shall be deposited in the Fund and credited as offsetting receipts."

(3) in subsection (d), by striking "for the period encompassing 15 years after the date of the enactment of this title" and inserting "through fiscal year 2026"; and

(4) in subsection (e):

(A) in paragraph (1), by striking "15 years after the date of the enactment of this title" and inserting "September 30, 2026";

(B) in *paragraph (2), by striking "$2,250,000,000" and inserting "$3,000,000,000"; and*

(C) in *paragraph (2) by inserting "beginning in fiscal year 2012" after "adjusted for inflation".*

SEC. 308. The Secretary shall collect up to $200,000,000 in assessments pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1), as amended by this Act.

SEC. 309. For an additional amount for the "Other Defense Activities" account, $11,891,755, to increase the Department's acquisition workforce capacity and capabilities: Provided, That such funds may be transferred by the Secretary to any other account in the Department to carry out the purposes provided herein: Provided further, That such transfer authority is in addition to any other transfer *authority provided in this Act: Provided further, That such funds shall be available only to supplement and not to supplant existing acquisition workforce activities: Provided further, That such funds shall be available for training, recruitment, retention, and hiring additional members of the acquisition workforce as defined by the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 401 et seq.): Provided further, That such funds shall be available for information technology in support of acquisition workforce effectiveness or for management solutions to improve acquisition management.*

SEC. 310. Not to exceed 5 per centum, or $100,000,000, of any appropriation, whichever is less, made available for Department of Energy activities funded in this Act or subsequent Energy and Water Development and Related Agencies Appropriation Acts may hereafter be transferred between such appropriations, but no appropriation, except as otherwise provided, shall be increased or decreased by more that 5 per centum by any such transfers, and any such proposed transfers shall be submitted to the Committee on Appropriations of the House and Senate. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. To the extent practicable funds made available in this Act should be used to purchase light bulbs that are "Energy Star" qualified or have the "Federal Energy Management Program" designation.

[SEC. 503. Title IV of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5) is amended by adding at the end of the title, the following new section 411:

"SEC 411. Up to 0.5 percent of each amount appropriated to the Department of the Army and the Bureau of Reclamation in this title may be used for the expenses of management and oversight of the programs, grants, and activities funded by such appropriation, and may be transferred by the Head of the Federal Agency involved to any other appropriate account within the department for that purpose: *Provided*, That the Secretary will provide a report to the Committees on Appropriations of the House of Representatives and the Senate 30 days prior to the transfer: *Provided further*, That funds set aside under this section shall remain available for obligation until September 30, 2012.".]

[SEC. 504. (a) DEFINITIONS.—In this section:

(1) *ADMINISTRATIVE* EXPENSES.—The term "administrative expenses" has the meaning as determined by the Director under subsection (b)(2).

(2) *AGENCY*.—The term "agency"—

(A) means an agency as defined under section 1101 of title 31, United States Code, that is established in the executive branch and receives funding under this Act; and

(B) shall not include the District of Columbia government.

(3) *DIRECTOR*.—The term "Director" means the Director of the Office of Management and Budget.

(b) ADMINISTRATIVE EXPENSES.—

(1) IN *GENERAL*.—All agencies shall include a separate category for administrative expenses when submitting their appropriation requests to the Office of Management and Budget for fiscal year 2011 and each fiscal year thereafter.

(2) *ADMINISTRATIVE* EXPENSES DETERMINED.—In consultation with the agencies, the Director shall establish and revise as necessary a definition of administration expenses for the purposes of this section. All questions regarding the definition of administrative expenses shall be resolved by the Director.

(c) BUDGET SUBMISSION.—Each budget of the United States Government submitted under section 1105 of title 31, United States Code, for fiscal year 2011 and each fiscal year thereafter shall include the amount requested for each agency for administrative expenses.]

[SEC. 505. None of the funds made available in this Act may be transferred to any department, agency, or instrumentality of the United States Government, except pursuant to a transfer made by, or transfer authority provided in this Act or any other appropriation Act.]

SEC. [506]*503.* [Specific projects contained in] *To the extent that* the report of the Committee on Appropriations of the House of Representatives accompanying this Act [(H. Rept. 111-203)] *includes specific projects* that are considered congressional earmarks for purposes of clause 9 of rule XXI of the Rules of the House of Representatives, *such projects,* when intended to be awarded to a for-profit entity, shall be awarded under a full and open competition. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

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Volume 6

Department of Energy
FY 2011 Congressional Budget Request

Power Marketing Administrations

Southeastern Power Administration
Southwestern Power Administration
Western Area Power Administration
Bonneville Power Administration

February 2010 Office of Chief Financial Officer Volume 6

Printed with soy ink on recycled paper

Volume 6

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The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

For the latest details on the Department of Energy's implementation of the Recovery Act, please visit: http://www.energy.gov/recovery

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2009 Current Approp	FY 2009 Current Recovery	FY 2010 Current Approp.	FY 2011 Congressional Request	FY 2011 vs. FY 2010	
					$	%
Discretionary Summary By Appropriation						
Energy And Water Development, And Related Agencies						
Appropriation Summary						
Energy Programs						
Energy efficiency and renewable energy	2,156,865	16,771,907	2,242,500	2,355,473	+112,973	+5.0%
Electricity delivery and energy reliability	134,629	4,495,712	171,982	185,930	+13,948	+8.1%
Nuclear energy	791,444	0	786,637	824,052	+37,415	+4.8%
Fossil energy programs						
Clean coal technology	0	0	0	0	—	—
Fossil energy research and development	863,104	3,398,607	672,383	586,583	-85,800	-12.8%
Naval petroleum and oil shale reserves	19,099	0	23,627	23,614	-13	-0.1%
Strategic petroleum reserve	226,586	0	243,823	138,861	-104,962	-43.0%
Strategic petroleum account	-21,586	0	0	0	—	—
Northeast home heating oil reserve	9,800	0	11,300	11,300	—	—
Total, Fossil energy programs	1,097,003	3,398,607	951,133	760,358	-190,775	-20.1%
Uranium enrichment D&D fund	535,503	390,000	573,850	708,498	+134,648	+23.5%
Energy information administration	110,595	0	110,595	128,833	+18,238	+16.5%
Non-Defense environmental cleanup	261,819	483,000	254,673	225,163	-29,510	-11.6%
Science	4,813,470	1,632,918	4,903,710	5,121,437	+217,727	+4.4%
Energy transformation acceleration fund	8,700	388,856	0	299,966	+299,966	N/A
Nuclear waste disposal	145,390	0	98,400	0	-98,400	-100.0%
Departmental administration	155,326	42,000	168,944	169,132	+188	+0.1%
Inspector general	51,927	15,000	51,927	42,850	-9,077	-17.5%
Advanced technology vehicles manufacturing loan	7,510,000	10,000	20,000	9,998	-10,002	-50.0%
Innovative technology loan guarantee program	0	0	0	500,000	+500,000	N/A
Section 1705 temporary loan guarantee program	0	3,960,000	0	0	—	—
Total, Energy Programs	17,772,671	31,588,000	10,334,351	11,331,690	+997,339	+9.7%
Atomic Energy Defense Activities						
National nuclear security administration:						
Weapons activities	6,410,000	0	6,384,431	7,008,835	+624,404	+9.8%
Defense nuclear nonproliferation	1,545,071	0	2,136,709	2,687,167	+550,458	+25.8%
Naval reactors	828,054	0	945,133	1,070,486	+125,353	+13.3%
Office of the administrator	439,190	0	410,754	448,267	+37,513	+9.1%
Total, National nuclear security administration	9,222,315	0	9,877,027	11,214,755	+1,337,728	+13.5%
Environmental and other defense activities:						
Defense environmental cleanup	5,656,345	5,127,000	5,642,331	5,563,039	-79,292	-1.4%
Other defense activities						
Health, safety and security	446,471	0	441,882	464,211	+22,329	+5.1%
Legacy Management	185,981	0	189,802	188,626	-1,176	-0.6%
Nuclear energy	565,819	0	83,358	88,200	+4,842	+5.8%
Defense related administrative support	108,190	0	122,982	130,728	+7,746	+6.3%
Office of hearings and appeals	6,603	0	6,444	6,444	—	—
Congressionally directed projects	999	0	3,000	0	-3,000	-100.0%
Total, Other defense activities	1,314,063	0	847,468	878,209	+30,741	+3.6%
Defense nuclear waste disposal	143,000	0	98,400	0	-98,400	-100.0%
Total, Environmental & other defense activities	7,113,408	5,127,000	6,588,199	6,441,248	-146,951	-2.2%
Total, Atomic Energy Defense Activities	16,335,723	5,127,000	16,465,226	17,656,003	+1,190,777	+7.2%
Power marketing administrations:						
Southeastern power administration	7,420	0	0	0	—	—
Southwestern power administration	28,414	0	13,076	12,699	-377	-2.9%
Western area power administration	218,346	10,000	109,181	105,558	-3,623	-3.3%
Falcon & Amistad operating & maintenance fund	2,959	0	220	220	—	—
Colorado River Basins	-23,000	0	-23,000	-23,000	—	—
Total, Power marketing administrations	234,139	10,000	99,477	95,477	-4,000	-4.0%
Federal energy regulatory commission	0	0	0	0	—	—
Subtotal, Energy And Water Development and Related Agencies	34,342,533	36,725,000	26,899,054	29,083,170	+2,184,116	+8.1%
Uranium enrichment D&D fund discretionary payments.	-463,000	0	-463,000	-696,700	-233,700	-50.5%
Excess fees and recoveries, FERC	-23,080	0	-28,886	-29,822	-936	-3.2%
Cost of implementing reclassification of receipts, PMAs	0	0	189,384	0	-189,384	-100.0%
Total, Discretionary Funding	**33,856,453**	**36,725,000**	**26,596,552**	**28,356,648**	**+1,760,096**	**+6.6%**

Southeastern Power Administration

Southeastern Power Administration

Proposed Appropriation Language

For necessary expenses of operation and maintenance of power transmission facilities and of marketing electric power and energy, including transmission wheeling and ancillary services pursuant to section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), as applied to the southeastern power area, [$7,638,000]*$8,034,000*, to remain available until expended: Provided, That notwithstanding 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944, up to [$7,638,000]*$8,034,000* collected by the Southeastern Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended for the sole purpose of funding the annual expenses of the Southeastern Power Administration: Provided further, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year [2010]*2011* appropriation estimated at not more than $0: Provided further, That notwithstanding 31 U.S.C. 3302, up to [$70,806,000]*$74,157,000* collected by the Southeastern Power Administration pursuant to the Flood Control Act of 1944 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures[:] [Provided further, That notwithstanding the provisions of 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944, all funds collected by the Southeastern Power Administration that are applicable to the repayment of the annual expenses of this account in this and subsequent fiscal years shall he credited to this account as discretionary offsetting collections for the sole purpose of funding such expenses, with such funds remaining available until expended] : Provided further, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses). (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

Southeastern Power Administration

Overview

Appropriation Summary by Program

	(dollars in thousands) FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Southeastern Power Administration			
Program Direction, (PD)	7,420	7,638	8,034
Purchase Power and Wheeling (PPW)	63,522	85,228	88,615
Subtotal, Southeastern Program Level	70,942	92,866	96,649
Offsetting Collections, Annual Expenses	0	-7,638	-8,034
Offsetting Collections, PPW	-49,520	-70,806	-74,157
Alternative financing, PPW	-14,002	-14,422	-14,458
Total, Southeastern Power Administration	7,420	0	0
Reclassification of Mandatory Receipts to Discretionary Offsetting Collections	0	7,638	0

Preface

As the Nation moves forward to strengthen its national and economic security, the Department of Energy (DOE or the Department) leads a critical effort promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy. Southeastern Power Administration (Southeastern or SEPA) exists to carry out the functions assigned by the Flood Control Act of 1944: to market the electric power and energy generated by the Federal reservoir projects, encourage widespread use of the power at the lowest cost to consumers and repay the Federal investment consistent with sound business principles.

Within the Southeastern appropriation, there is one program, Operation and Maintenance, which includes two subprograms: Program Direction and Purchase Power and Wheeling. Program Direction supports day-to-day agency operation and Purchase Power and Wheeling supports acquisition of contractually-required transmission services and power purchases. Consistent with the authority provided in the 2010 Energy and Water Appropriations, the FY 2011 Budget provides funding for annual expenses (program direction) through discretionary offsetting collections derived from power receipts collected to recover those expenses.

Mission

The mission of Southeastern is to market and deliver Federal hydroelectric power at the lowest possible cost to public bodies and cooperatives in the southeastern United States in a professional, innovative, customer-oriented manner, while continuing to meet the challenges of an ever-changing electric utility environment through continuous improvements.

Benefits

Southeastern supports the Department's Energy Security Goal by promoting energy efficiency and renewable energy and managing the dispatch and distribution of Federal hydroelectric power resources in the southeastern United States in a safe, affordable, and environmentally sound manner, while meeting national utility performance standards and balancing the diverse interests of other water resource users. This budget submission ensures effective management of Federal hydroelectric power resources and provides for: a diverse supply of generating resources that enhance regional power system reliability; power revenues that repay taxpayers' investment in the Federal power system; and regional economic benefits from delivery of Federal power primarily to rural electric cooperatives, municipal utilities, and other public entities. Southeastern has implemented rates that repay emergency power purchases within the fiscal year that they are incurred and is on track to repay the Federal investment in hydroelectric resources within required time periods.

This budget submission enables Southeastern to support the Energy Security Goal by promoting strategies that enhance energy efficiency and renewable energy technologies. Effective management of hydroelectric resources, combined with promotion of energy efficiency and renewable technologies, contributes to the long-term solution of economic and environmental challenges associated with electricity demand.

Performance

Southeastern contributes to Secretarial Goal 2, Energy: Southeastern generates clean zero carbon emissions hydroelectric power. Southeastern accomplishes Goal 2 through two subprograms (Purchased Power and Wheeling, and Program Direction) supported by, appropriations offset by receipts, Federal power receipts, and alternative financing arrangements, including net billing, bill crediting. With this Goal, Southeastern performs its mission in a manner that promotes maintaining and upgrading its energy infrastructure to ensure reliable and efficient delivery of Federal power, which is an integral part of the Nation's electrical grid.

Southeastern Power Administration

Funding by Site by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Southeastern Power Administration	70,942	92,866	96,649
Total, Southeastern Power Administration	70,942	92,866	96,649

Major Changes or Shifts by Site

Purchase Power and Wheeling

- Additional Dam Safety issues have been discovered at several projects in the Cumberland System. It is likely that the interim operating plan, which fundamentally alters the operation of the Cumberland System, will continue through 2014.

Site Description

Southeastern is one of four Power Marketing Administrations within the Department of Energy. Southeastern was created in 1950 to market power and energy produced at Corps hydroelectric power projects. Southeastern markets power at wholesale rates to 293 publicly owned utilities, 199 rural electric cooperatives, and one investor-owned utility in the 11 States of Florida, Georgia, South Carolina, North Carolina, Tennessee, Alabama, Mississippi, Virginia, West Virginia, Kentucky, and Illinois. Southeastern is located in Elberton, Georgia, and has no field offices.

Southeastern Power Administration

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Southeastern Power Administration			
Program Direction (PD)	7,420	7,638	8,034
Purchase Power and Wheeling (PPW)	63,522	85,228	88,615
Subtotal, Southeastern Program Level	70,942	92,866	96,649
Offsetting collections, Annual Expenses	0	-7,638	-8,034
Offsetting collections, PPW	-49,520	-70,806	-74,157
Alternative financing, PPW	-14,002	-14,422	-14,458
Total, Southeastern Power Administration	7,420	0	0

Public Law Authorizations:
Public Law 78-534, Flood Control Act of 1944
Public Law 95-91, DOE Organization Act of 1977, Section 302
Public Law 101-1-1, Title III, Continuing Fund (amended 1989)
Public Law 102-486, Energy Policy Act of 1992

Mission

Southeastern's power marketing and wheeling activities fulfill the requirements of Section 5 of the Flood Control Act of 1944 and reflect Southeastern's goals and objectives to market and deliver cost-based power in a safe and reliable manner, and repay the Federal investment with interest, while providing environmental and economic benefits to the region. Southeastern focuses on its repayment goal, which assures timely repayment of the Federal hydropower investment.

Benefits

Southeastern's appropriation supports the Energy Strategic Goal of the Department's mission by providing delivery of reliable, affordable, and environmentally sound energy. Southeastern, in conjunction with the U. S. Army Corps of Engineers (Corps), participates in this effort by managing the power delivery from multiple-purpose hydropower projects through effective marketing, and delivery of clean, safe, reliable, cost-based electric power. This Federal program provides reliable energy to the Nation, which can "cold-start" other power generation sources during energy emergencies.

Southeastern's program provides numerous benefits to the Nation. The significant benefits are:

- Operating a reliable Federal power system in the most effective, cost-efficient, and environmentally sound manner, while meeting national utility performance standards and balancing the diverse interests of other water resource users.

- Repaying taxpayers' investments in the Federal power system.
- Providing reliable delivery of power to customers.
- Providing low-cost power and increased competition in the region.
- Promoting regional economic growth.

Climate Change Technology Program Benefits

Southeastern contributes program benefits in support of Climate Change activities by reducing carbon emissions through generation of hydroelectric power, which has zero carbon emissions. Southeastern's stream-flow generation of 5,483 GWH in FY 2009 offset fossil fuel resources and reduced overall CO2 emissions by 3.9 million metric tons. Southeastern supports the Climate Change and Technology Program by promoting residential, commercial, and industrial energy efficiency, as well as development of wind, solar, and biomass technologies when they are economically feasible. Southeastern works closely with DOE's Energy Efficiency and Renewable Energy programs to ensure that municipal and cooperative utilities in the southeast benefit from Federal services and technologies.

Contribution to the Secretary's Goals

Southeastern contributes to the Secretary's Goal 2: Energy: by delivering over 3,000 mega-watts of carbon free hydroelectric capacity to municipal and cooperative customers in its marketing area. Southeastern is actively engaged with its customers to improve existing hydroelectric project efficiency through operations and rehabilitation in order to extend their economic life and generate power more efficiently. Project rehabilitation improves the generating infrastructure and promotes economic prosperity by putting skilled labor to work. Project-by-project rehabilitation will continue to offset fossil generation and reduce emissions into the foreseeable future. Southeastern's Energy Efficiency and Renewable Energy Program helps reduce end-use energy demand by providing training opportunities to its customers to assist with their energy auditing, weatherization, ventilation, controls and lighting technology activities. Southeastern also provides educational opportunities to help its customers deploy renewable energy technologies as they develop renewable energy portfolios. All of Southeastern's efforts help enhance the green workforce by putting people to work directly through project rehabilitation or by providing energy efficiency and renewable energy education opportunities.

Contribution to GPRA Unit Program Goal 1.3.23.00, Energy Infrastructure

Southeastern contributes to the Energy Infrastructure Goal by performing its power marketing mission through two subprogram activities: Program Direction and Purchase Power and Wheeling. Southeastern contributes to Strategic Theme 1, Energy Security, by marketing and delivering all available hydroelectric power from Corps dams, while balancing power needs with the diverse interests of other water resource users; and markets and delivers Federal power in a cost-efficient manner to assure reliability of the power system and maximize the use of Federal assets to repay the investment (principal and interest).

Means and Strategies

Southeastern will use various means and strategies to achieve its GPRA Unit Program goals. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

Southeastern will implement the following means:

- Operate the Federal power system effectively and efficiently by providing training and certification to update workforce skills and by updating power system operation technologies to maintain required industry standard compliance.
- Assure power rates are adequate to repay the Federal investment by conducting annual power repayment studies.
- Conduct business process reviews to maximize efficiency and eliminate redundancy.
- Provide economic benefits to the region by marketing and delivering all available hydropower.

Southeastern will implement the following strategies:

- Market and deliver power using appropriations, net billing, bill crediting, and offsetting collections.
- Maintain a diverse and knowledgeable workforce by providing employee training, leadership development, retention programs, and recruitment activities.
- Market all available hydropower by working with the Corps, other Federal entities, States, cooperative and municipal utilities to meet the expectations of our customers, while balancing the interest of other water users.
- Maintain the security of the Federal power system, facilities, and information technology (IT) systems.
- Address industry restructuring changes, when needed, by reclassifying positions as opportunities arise.
- Maximize the capabilities of business systems to improve processes and provide greater efficiency.
- Promote adoption of energy efficiency and renewable energy among Federal power customers.

These strategies will result in a well-maintained Federal power system that is in compliance with the Federal Energy Regulatory Commission (FERC), Electric Reliability Organization (ERO) operating regulations and an expert workforce to operate the system in the most effective and cost-efficient manner possible.

The following external factors could affect Southeastern's ability to achieve its program goals:

- Achieving and maintaining system reliability can be affected by weather, natural disasters, changes in the North American Electric Reliability Corporation (NERC) operating standards, new load patterns, deregulation of the electricity market, changing electric industry organizational structures, and additions to other transmission systems interconnected to the Federal system.
- Achieving full repayment of the Federal power investment and enhancing economic growth to the region can be affected by weather, power markets, natural disasters, and other external costs and revenue factors.
- Statutory or administrative reallocation of water storage from hydropower to water supply.

In carrying out its mission to market and deliver hydroelectric power, Southeastern performs the following collaborative activities:

- Southeastern coordinates operational activities with NERC, other regional electric reliability councils, the Corps, customers and other stakeholders to provide the most efficient use of Federal assets.

Validation and Verification

To validate and verify program performance, Southeastern conducts internal and external reviews. Southeastern's programmatic activities are subject to continuing review by internal and external entities such as Congress, the Government Accountability Office , the Department of Energy, the Department of Energy's Inspector General, FERC, the U.S. Environmental Protection Agency, the Office of Personnel

Management, Southeastern, and National and Regional Reliability Corporations. Southeastern's annual financial statements are audit by an independent accounting firm.

Southeastern also complies with Cyber Security requirements, as directed by the Department of Energy and NERC. Southeastern is audited by DOE and NERC, as well as internal audits and reviews by the other Power Marketing Administrations and independent auditors every three years for recertification. Compliance with NERC standards is filed each year through regional reliability organizations. The Department of Energy also requires Southeastern to follow the National Institute of Standards (NIST) and the Federal Information Processing Standards (FIPS).

Annual Performance Targets and Results

Secretarial Goal 2: Energy: Build a competitive, low-carbon economy and secure America's energy future

GPRA Unit Program Goal: Southeastern Power Administration, Operation and Maintenance - Provide the benefits of Federal power to customers by selling and reliably delivering power from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**
Performance Measure: Meet NERC Control Performance Standards (CPS) of CPS1>100 and CPS2>90 and meet or exceed industry averages. CPS1 measures a generating system's performance at matching supply to changing demand requirements and supporting desired system frequency in one minute increments. CPS2 measures a generating system's performance at limiting the magnitude of generation and demand imbalances in ten minute increments.									
CPS1									
T: >100 A: 201	T: >100 A: 186	T: >100 A: 207	T: >100 A: 225	T: >100 A:	T: >100 A:	T: >100 A:	T: >100 A:	T: >100 A:	T: >100 A:
CPS2									
T: >90 A: 100	T: >90 A: 100	T: >90 A: 100	T: >90 A: 100	T: >90 A:	T: >90 A:	T: >90 A:	T: >90 A:	T: >90 A:	T: >90 A:
Performance Measure: Provide power at the lowest possible cost by keeping total operation and maintenance expense per kilowatt-hour generated below the National median for public power.*									
				T: <$0.062/kWh A:	T: <$0.062/kWh A:	T: <$0.062/kWh A:	T: <$0.062/kWh A:	T: <$0.062/kWh A:	T: <$0.062/kWh A:
*Performance Measure was added in FY 2010. Future year targets will be adjusted based on the actual national median for public power.									
Performance Measure: Ensure timely repayment of Federal investment in accordance with DOE Order RA 6120.2 by maintaining unpaid investment (UI) equal to or less than the allowable unpaid investment (AUI) **(Definition Revised in 2010).**									
T: UI/AUI<=1 A: UI/AUI<=1	T: UI/AUI<=1 A: UI/AUI<=1	T. UI/AUI<=1 A: UI/AUI<=1	T: UI/AUI<=1 A: UI/AUI<=1	T: UI/AUI<=1 A	T: A:	T: A:	T: A:	T: A:	T: A

Purchase Power and Wheeling

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Purchase Power and Wheeling			
Purchase Power	28,349	49,000	50,947
Wheeling	35,173	36,228	37,668
Subtotal, Purchase Power and Wheeling	63,522	85,228	88,615
Alternative Financing			
Net Billing	-14,002	-14,422	-14,458
Subtotal, Purchase Power and Wheeling	49,520	70,806	74,157
Offsetting Collections Realized	-49,520	-70,806	-74,157
Total, Purchase Power and Wheeling Budget Authority	0	0	0

Description

The mission of Purchase Power and Wheeling (PPW) is to provide funding for acquisition of transmission services, ancillary services for the system, and pumping energy for the Richard B. Russell and Carters Pumped Storage units and support of the Jim Woodruff Project. Purchase power and transmission expenses are based on contracts Southeastern maintains with area transmission providers that agree to deliver specified amounts of Federal power from the hydropower projects to Federal power customers. Southeastern has access to a continuing fund for emergency power purchases. Southeastern has a plan implemented to repay Purchase Power and Wheeling expenditures made through the Continuing Fund within one year.

The FY 2011 request uses customer receipts and net billing to pay for purchase power and wheeling expenses. Southeastern's Federal appropriation allows customers to fund purchase power and wheeling expenses in FY 2011 and subsequent years at no cost to the Federal Treasury. Some customers, acting independently or in partnerships, acquire replacement power and transmission services directly from suppliers. Southeastern will continue to assist its customers by arranging funding for these activities through alternative financing instruments, as needed.

Benefits

The PPW subprogram supports Southeastern's mission to market and deliver reliable, cost-based hydroelectric power and related services. Southeastern's priority to maintain acceptable power system operation for control area performance, as measured using NERC CPS 1 & 2, provides assurance that projects within Southeastern's control area operate as reliable and efficient grid resources. PPW enables Southeastern to wheel Federal power to preference customers, purchase replacement power, and acquire pumping energy to maximize the efficiency and benefits of Southeastern's hydropower resources. Power and services are marketed at rates designed to provide recovery of expenses and Federal investment, as established by law. The recovery of the Federal investment, or repayment, is a key performance goal for Southeastern. The Department of Energy's Strategic Plan reinforces the importance of domestic, renewable hydroelectric energy by emphasizing its ongoing significant contribution to the Nation's past and future energy supply and Southeastern's role as a power resource by supplying hydroelectric power to its customers.

Detailed Justification

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Purchase Power	**28,349**	**49,000**	**50,947**
▪ Pumping: Russell Project Purchase off-peak energy to pump water into the Richard B. Russell Project for on peak generation	15,228	31,100	19,000
▪ Pumping: Carters Project Purchase off-peak energy to pump water into the Carters Project for on peak generation	12,221	16,900	16,647
▪ Replacement Energy	0	0	12,100
▪ Support Jim Woodruff Project Purchase of energy during periods of adverse water conditions including floods (loss of head) and drought	900	1,000	3,200
Wheeling	**35,173**	**36,228**	**37,668**
▪ Wheeling service charges Wheeling service charges for delivery of power over non-Federal systems	30,469	31,524	32,904
▪ Ancillary Services Payment for ancillary services	4,704	4,704	4,764
Total, Purchase Power and Wheeling	**63,522**	**85,228**	**88,615**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Purchase Power and Wheeling Expected pumping energy costs are the result of increased fuel and fuel transportation expenses incurred by utilities that provide pumping energy. Transmission cost increases also added to higher PPW expenses.	+3,387
Total, Purchase Power and Wheeling	+3,387

Program Direction
Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Southeastern Power Administration			
Salaries and Benefits	4,976	5,199	5,433
Travel	467	476	586
Support Services	60	61	62
Other Related Expenses	1,917	1,902	1,953
Subtotal, Program Direction	7,420	7,638	8,034
Offsetting Collections, Annual Expenses	0	-7,638	-8,034
Total Program Direction Budget Authority	7,420	0	0
Total, Full Time Equivalents	44	44	44

Mission

Program direction makes available the Federal staffing resources and associated funding necessary to provide overall direction and execution of Southeastern's program. All of Southeastern's annual expenditures are repaid within one year. Southeastern's de minimis capital expenditures are also repaid within one year, and for budget purposes, deemed annual expenses. Southeastern coordinates and cooperates with its partners to operate projects in a manner that enhances the value and reliability of hydropower. Priority is given to integrating environmental concerns and determinations into program actions. Emerging energy efficiency and renewable energy technologies are integrated with marketing strategies and programs.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**4,976**	**5,199**	**5,433**

Funding supports salaries and benefits for 44 Federal employees who market Federal hydropower, promote energy efficiency and renewable energy, and provide administrative support. The salary estimate is derived from the current year budgeted salaries, plus cost-of-living adjustments, promotions, within-grade increases, DOE-cascading performance awards, retirement payouts for unused leave (annual retirements of five FTEs are anticipated over the planning horizon), and overtime. Benefits are calculated as a percentage of prior years actual. The funding provides for negotiation, preparation, execution, and administration of all contracts for the disposition of electric power, and ensures continuity of electric service to customers. Funding also covers operators who coordinate and schedule pumping energy among providers of pumping energy and the projects and account for all transactions relative to pumping operations of the Carters and Richard B. Russell Projects. Personnel perform Balancing Authority services for Hartwell, Russell, and Thurmond Projects. Southeastern coordinates power operations of projects with all parties, making determinations of capacity and energy availability weekly. Efficiency Performance is measured by two Efficiency Performance Indicators that provide Balancing Area compliance ratings. Funding provides for accounts receivable and payable functions for approximately 300 contracts that benefit more than 500 preference customers. Southeastern executes budget, accounting, and financial management activities, prepares repayment analyses of each system to determine rates, and organizes rate forums, as needed. Repayment performance is measured by comparing required to actual repayment of principal on power investment. In support of the Energy Policy Act of 2005 and the Department's Strategic Goal 1.3, Southeastern vigorously promotes energy efficiency and development of renewable energy among its customers. Funding also covers continuing engineering studies, review of project operations, and evaluation of impacts of proposed or actual changes to project operations. Funding also supports IM and Homeland Security initiatives.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Travel	**467**	**476**	**586**

Travel supports transportation and per diem expenses incurred for participation in and development of regional transmission organizations; training expenses for power operator certification; relocation expenses for new FTEs; contract negotiations; preference customer meetings; rate forums; hearings and meetings; Congressional hearings; site visits of existing and new projects; promotion of energy efficiency and renewable energy via Competitive Resource Strategy workshops and meetings; operations meetings with industry self-regulating groups. Self-regulating groups include: SERC Reliability Corporation , Virginia Carolina Electric Reliability Group, NERC; ERO; hydropower task force and project rehabilitation meetings with the Corps, Customer, and SEPA Working Group; National Environmental Policy Act activities; training; Power Marketing Policy Forums; national and state customer meetings with the National Rural Electric Cooperative Association , the American Public Power Association ; Southeastern Federal Power Customers O&M Subcommittee meetings; Interagency Task Force on Finance; Technical Advisory Group meetings; FERC pre-filings and hearings; PJM RTO; and headquarters responsibilities.

Support Services	**60**	**61**	**62**

The Energy Efficiency and Renewable Energy Program supports preference customer efforts to address energy efficiency issues, and promote development of renewable resources in support of the Department's Strategic Plan Goal 1.3 and the Energy Policy Act of 2005. Develop specifications for training programs, prepare program plans, conduct training, and review and evaluate contractors.

Other Related Expenses	**1,917**	**1,902**	**1,953**

Provide administrative support for the office, rent, communications, maintenance, contract services (library services, support for DOE Power Marketing Liaison Office, independent audit of the Southeastern Federal Power Program financial statements), E-GOV, supplies, materials, and equipment and support for cyber and physical security initiatives associated with Homeland Security[a]. Support installation of electronic hardware and software for the operations center and provide maintenance to integrate real-time data from the control area and provide the data to other transmission operators and NERC. This equipment supports additional NERC compliance requirements and system reliability. This system is a resource-intensive application that requires maintenance of interconnected fiber optic communication lines for the Supervisory Control and Data

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[a] Southeastern is required to meet the Common Identification Standard for Federal Employees and Contractors, as required by HSPD-12, FIPS Publication 201, Personal Identification Verification for Federal Employees and Contractors, NIST 800-73, Integrated Circuit Card for Personal Identity and Verification for Federal Employees and Contractors, NIST 800-76, Biometric Data Specification for Personal Identity Verification and all other DOE requirements.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

Acquisition system. Also reflects expenses associated with infrastructure support: telecommunications equipment; accounting system maintenance; building and computer security equipment; computer hardware and software; and office equipment and financial management system (Oracle). This funding allows the agency to fulfill its obligations under Strategic Theme 1, Energy Security and Goal 1.3, Energy Infrastructure.

	FY 2009	FY 2010	FY 2011
Total, Program Direction	**7,420**	**7,638**	**8,034**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits	
Fiscal Year 2011 salaries are derived from budgeted FY 2010 salaries and benefits, plus cost-of-living adjustments, promotions, within-grade increases, DOE-cascading performance awards, retirement payouts for unused leave, and overtime.	+234
Travel	
Derived from permanent change of station (PCS) expenses and increased travel and training for Operators, IT and security purposes.	+110
Support Services	
Increase in funding for co-sponsored energy efficiency and renewable energy support programs for municipal and cooperative utilities.	+1
Other Related Expenses	
▪ Communication expenses primarily reflect NERC operating requirements.	+12
▪ Rent expense increase due to normal inflation.	+6
▪ Maintenance expenses reflect increases in Operations Center Frame Relay and Data acquisition system maintenance.	+6
▪ Equipment expense increases reflect normal inflation and include operation center equipment upgrades required to maintain NERC reliability compliance.	+4
▪ Contract services reflect normal increases in contracting services including Oracle. FY11 and 13 include added expense for IT Security Assessment FY11 reflects IT security assessment additional expense.	+18
▪ Audit of financial statements reflect normal inflation.	+5
Subtotal, Other Related Expenses	+51
Total Funding Change, Program Direction	**+396**

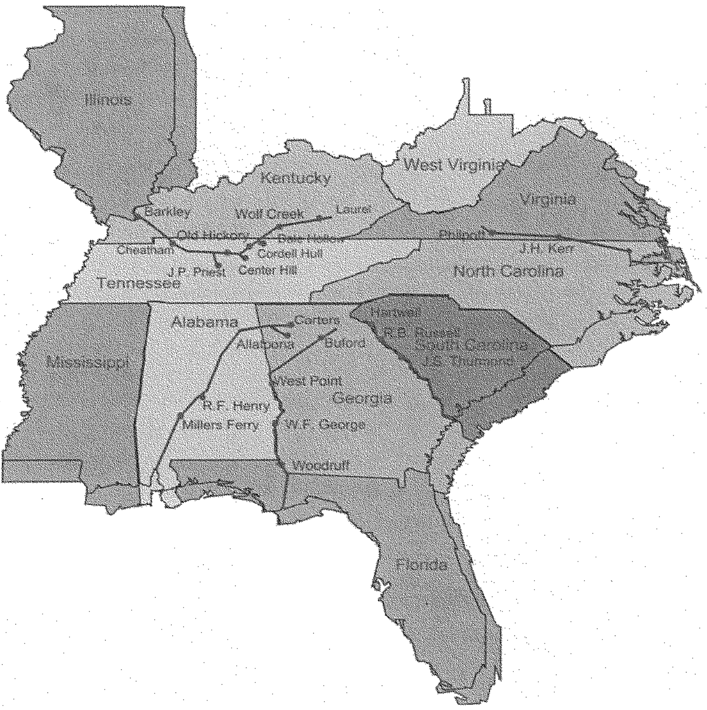
Support Services by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Management and Professional Support Services			
Co-sponsored energy efficiency services and renewable energy acquisition support for municipal and cooperative utilities	60	61	62
Total, Management and Professional Support Services	60	61	62

Other Related Expenses by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Rent to GSA	355	364	370
Rent to Others	9	9	9
Audit of Financial Statements	250	256	261
Communications, Utilities, Misc.	306	323	335
Printing and Reproduction	4	4	4
Tuition	16	16	16
Maintenance Agreements	127	134	140
Supplies and Materials	114	116	116
Contract Services	416	439	457
Equipment	288	208	212
Working Capital Fund	32	33	33
Total, Other Related Expenses	1,917	1,902	1,953

Service Area Map



Revenue and Receipts

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Southeastern Power Administration Gross Revenues	236,064	240,720	298,268	300,543	305,809	307,175	309,960
Net Billing (Credited as an Offsetting Receipt)	-14,002	-14,422	-14,458	-14,708	-14,954	-15,212	-15,483
Total Cash Receipts	222,062	226,298	283,810	285,835	290,855	291,963	294,477
Continuing Fund							
Use of Offsetting Collections to fund PPW	-49,520	-70,806	-74,157	-76,381	-78,673	-81,033	-83,464
Use of Offsetting Collections to fund Annual Expenses	0	-7,638	-8,034	-8,226	-8,532	-8,848	-9,024
Total Receipts, net use of Offsetting Collections	172,542	147,854	201,619	201,228	203,650	202,082	201,989
Cumberland Rehabilitation	-20,000	-20,000	-20,000	-20,000	-20,000	-20,000	-20,000
GA-AL-SC Rehabilitation	-15,000	-15,000	-15,000	-15,000	-15,000	-15,000	-15,000
Kerr-Philpott Rehabilitation	-600	-600	-600	-600	-600	-600	-600
Jim Woodruff	0	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Total Proprietary Receipts	136,942	111,254	165,019	164,628	167,050	165,482	165,389
Percent of Sales to Preference Customers	99%	99%	99%	99%	99%	99%	99%
Energy Sales and Power Marketed (megawatt-hours)	7,886,000	7,886,000	7,886,000	7,886,000	7,886,000	7,886,000	7,886,000

System Statistics

	FY 2009 Actual	FY 2009 Estimate	FY 2010 Estimate
Generating Capacity:			
Nameplate Capacity (KW)	3,392,375	3,392,375	3,392,375
Peak Capacity (KW) [a]	3,710,000	3,710,000	3,710,000
Generating Stations			
Generating Projects (Number)	22	22	22
Available Energy			
Energy from Stream-flow (MWH)	7,459,272	7,459,272	7,459,272
Energy generated from Pumping (MWH)	427,128	427,128	427,128
Energy Purchased for Replacement (MWH)	75,000	75,000	75,000
Total, Energy available for marketing [b] (MWH)	7,961,400	7,961,400	7,961,400

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[a] Southeastern markets capacity based on nameplate plus an overload factor. NERC requires that Southeastern keep a portion of the capacity in reserve for emergency purposes and to cover losses.
[b] Gross amount. Transmission losses are deducted from this amount to estimate the amount of energy marketed.

Power Marketed, Wheeled, or Exchanged by Project

Project	State	Plants	Installed Capacity (KW)	FY 2009 Estimated Power (GWH)	FY 2010 Estimated Power (GWH)	FY 2011 Estimated Power (GWH)
Kerr-Philpott System				463*	463*	463*
John H. Kerr	VA-NC	1	204,000			
Philpott	VA	1	14,000			
Georgia-Alabama-South Carolina System				4,059*	4,059*	4,059*
Allatoona	GA	1	74,000			
Buford	GA	1	86,000			
Carters	GA	1	500,000			
J. Strom Thurmond	GA-SC	1	280,000			
Walter F. George	GA-AL	1	130,000			
Hartwell	GA-SC	1	344,000			
R. F. Henry	AL	1	68,000			
Millers Ferry	AL	1	75,000			
West Point	GA-AL	1	73,375			
Richard B. Russell	GA-SC	1	600,000			
Jim Woodruff Project	FL-GA	1	30,000	237	237	237
Cumberland System				3,127*	3,127*	3,127*
Barkley	KY	1	130,000			
Center Hill	TN	1	135,000			
Cheatham	TN	1	36,000			
Cordell Hull	TN	1	100,000			
Dale Hollow	TN	1	54,000			
Old Hickory	TN	1	100,000			
J. Percy Priest	TN	1	28,000			
Wolf Creek	TN	1	270,000			
Laurel	TN	1	61,000			
Total Power Marketed		22	3,392,375	7,886	7,886	7,886

Alternative Financing

2009	Transmission	Purchase Power	Offsetting Collections	Net Billing	Appropriated Funds
Jim Woodruff System	0	900	-700	-200	0
Kerr-Philpott System	4,704	0	-4,704	0	0
GA-AL-SC System	20,402	27,449	-43,941	-3,910	0
Cumberland System	9,762	0	-175	-9,587	0
	34,868	28,349	-49,520	-13,697	0

2010	Transmission	Purchase Power	Offsetting Collections	Net Billing	Appropriated Funds
Jim Woodruff System	0	1,000	-800	-200	0
Kerr-Philpott System	4,704	0	-4,704	0	0
GA-AL-SC System	21,757	48,000	-65,302	-4,455	0
Cumberland System	9,767	0	0	-9,767	0
	36,228	49,000	-70,806	-14,422	0

2011	Transmission	Purchase Power	Offsetting Collections	Net Billing	Appropriated Funds
Jim Woodruff System	0	3,200	-3,000	-200	0
Kerr-Philpott System	9,517	0	-9,517	0	0
GA-AL-SC System	18,378	47,747	-61,454	-4,671	0
Cumberland System	9,773	0	-186	-9,587	0
	37,668	50,947	-74,157	-14,458	0

Southwestern Power Administration

Southwestern Power Administration

Proposed Appropriation Language

For necessary expenses of operation and maintenance of power transmission facilities and of marketing electric power and energy, for construction and acquisition of transmission lines, substations and appurtenant facilities, and for administrative expenses, including official reception and representation expenses in an amount not to exceed $1,500 in carrying out section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), as applied to the southwestern power area, [$44,944,000] *$46,312,000*, to remain available until expended: *Provided*, That notwithstanding 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), up to [$31,868,000] *$33,613,000* collected by the Southwestern Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended, for the sole purpose of funding the annual expenses of the Southwestern Power Administration: *Provided further*, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year [2010] *2011* appropriation estimated at not more than [$13,676,000] *$12,699,000*: *Provided further*, That, notwithstanding 31 U.S.C. 3302, up to [$38,000,000] *$39,000,000* collected by the Southwestern Power Administration pursuant to the Flood Control Act of 1944 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures[:] [*Provided further*, That notwithstanding 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944, all funds collected by the Southwestern Power Administration that are applicable to the repayment of the annual expenses of this account in this and subsequent fiscal years shall be credited to this account as discretionary offsetting collections for the sole purpose of funding such expenses, with such funds remaining available until expended]: *Provided further*, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses). (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

Southwestern Power Administration
Overview

Appropriation Summary by Program

	(dollars in thousands)		
	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Southwestern Power Administration			
Operation and Maintenance	89,186	94,944	99,130
Subtotal, Southwestern Power Administration	89,186	94,944	99,130
Offsetting Collections, Annual Expenses	0	-31,868	-33,613
Offsetting Collections, Purchased Power and Wheeling (PPW) [a]	-35,000	-38,000	-39,000
Alternative Financing	-25,772	-12,000	-13,818
Total, Southwestern Power Administration	28,414	13,076	12,699
Reclassification of Mandatory Receipts to Discretionary Offsetting Collections	0	31,868	0

Preface

The U.S. Department of Energy (DOE) is leading the Nation forward to strengthen its national energy and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy. Southwestern Power Administration (Southwestern) exists to meet its public responsibilities consistent with the Flood Control Act of 1944: to market and reliably deliver Federal power, recover power costs, and repay the Federal investment consistent with sound business principles, giving preference to public bodies and cooperatives while encouraging the most widespread use of power and implementing public policy.

Within the Southwestern appropriation, there is one program: Operation and Maintenance, with four subprograms: Operations and Maintenance, Construction, Purchased Power and Wheeling, and Program Direction. Consistent with the authority provided in the 2010 Energy and Water Appropriations, the FY 2011 Budget provides funding for annual expenses (operations and maintenance and program direction) through discretionary offsetting collections derived from power receipts collected to recover those expenses.

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[a] Southwestern's budget request for the Purchased Power and Wheeling subprogram reflects anticipated needs to ensure adequate funding to fulfill its 1200-hour peaking power contractual obligations based on volatile market prices, limited availability of energy banks, and all but the most severe hydrological conditions.

Mission

The mission of Southwestern is to market and reliably deliver Federal hydroelectric power, with preference to public bodies and cooperatives. This is accomplished by maximizing the use of Federal assets to repay the Federal investment and participating with other water resource users in an effort to balance their diverse interests with power needs within broad parameters set by the U. S. Army Corps of Engineers (Corps), and implementing public policy.

Benefits

Southwestern's appropriation supports DOE's Energy Strategic Theme 1, Energy Security, by enabling the delivery of reliable, affordable, and environmentally sound energy, and operating a reliable transmission system which is an integral part of the Nation's transmission grid. Southwestern, in conjunction with the Corps, participates in this effort by strategically managing the multipurpose operation of the Federal hydropower system. This enables effective marketing, generation, and delivery of clean, reliable, cost-based electric power.

Southwestern's program provides the Nation numerous benefits, which include:

- Operating a reliable Federal power system in an effective, cost-efficient, and environmentally sound manner while meeting national utility performance standards and balancing the diverse interests of other water resource users,
- Producing power at the lowest cost-based rates possible, consistent with sound business practices,
- Repaying the American taxpayers' investments in the Federal power system,
- Delivering reliable power to its customers,
- Providing economic benefits to the region,
- Providing regional power restoration assistance to other non-hydropower generation sources during power grid emergencies,
- Repaying the costs of operation of the Federal hydropower system with revenues from power customers,
- Complying with the North American Electric Reliability Corporation (NERC) requirements, and
- Complying with the Federal Energy Regulatory Commission (FERC) requirements consistent with Federal statute.

Performance

Southwestern contributes to the Department's Strategic Theme 1, Energy Security; Strategic Goal 3, Energy Infrastructure; and Secretarial Goal 2, Energy through four subprograms (Operations and Maintenance, Construction, Purchased Power and Wheeling, and Program Direction) supported by appropriations, appropriations offset by receipts, Federal power receipts, and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances). Southwestern accomplishes this by performing its mission in a manner that promotes maintaining and upgrading its energy infrastructure to ensure reliable and efficient delivery of Federal power, which is an integral part of the Nation's electrical grid. Southwestern is modernizing its energy infrastructure; incrementally improving facilities, increasing transmission capacity where feasible, and enhancing transmission grid reliability to support the rapid changing utility industry, interconnection requests, evolving regional needs, and interest in renewable resources.

Southwestern Power Administration

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Southwestern Power Administration	89,186	94,944	99,130
Total, Southwestern Power Administration	89,186	94,944	99,130

Site Description

An Agency of the Department of Energy, Southwestern Power Administration (Southwestern) was created in 1943 to market and deliver power and energy produced at U.S. Army Corps of Engineers (Corps) hydroelectric power projects. Southwestern markets and delivers power at wholesale rates to 78 municipal utilities, 22 rural electric cooperatives, and 3 government entities in the 6 states of Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas. In order to integrate the operation of the Federal hydroelectric generating plants and to transmit power from 24 multi-purpose Corps dams to customers, Southwestern operates and maintains 1,380 miles of high-voltage transmission lines, 25 substations/switchyards, and 51 microwave and very high frequency radio sites. Southwestern operates from its Headquarters in Tulsa, Oklahoma; a Dispatch Center in Springfield, Missouri; and maintenance facilities in Jonesboro, Arkansas; Gore, Oklahoma; and Springfield, Missouri.

Operation and Maintenance

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Operation and Maintenance			
Program Direction (PD)	24,330	27,153	28,381
Operations and Maintenance (O&M)	12,865	13,775	13,676
Construction (CN)	5,991	6,016	8,073
Purchased Power and Wheeling (PPW)	46,000	48,000	49,000
Subtotal, Operation and Maintenance	89,186	94,944	99,130
Offsetting Collections, PPW [a]	-35,000	-38,000	-39,000
Offsetting Collections, PD (annual expenses)	0	-26,247	-26,880
Offsetting Collections, O&M (annual expenses)	0	-5,621	-6,733
Alternative Financing, PD	-2,200	0	-281
Alternative Financing, O&M	-9,381	0	-1,537
Alternative Financing, CN	-3,191	-2,000	-2,000
Alternative Financing, PPW	-11,000	-10,000	-10,000
Total, Operation and Maintenance	28,414	13,076	12,699

Public Law Authorizations:

Public Law No. 78-534, Section 5, Flood Control Act of 1944
Public Law No. 95-91, Section 302, DOE Organization Act of 1977
Public Law No. 100-71, Supplemental Appropriations Act, 1987
Public Law No. 101-101, Title III, Continuing Fund (amended 1989)
Public Law No. 102-486, Section 721, Energy Policy Act of 1992
Public Law No. 108-137, Appropriations Act, FY 2004
Public Law No. 111-85, Appropriation Act, FY 2010

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[a] Southwestern's budget request for the Purchased Power and Wheeling subprogram reflects anticipated needs to ensure adequate funding to fulfill its 1200-hour peaking power contractual obligations based on volatile market prices, limited availability of energy banks, and all but the most severe hydrological conditions.

Mission

The mission of the Operation and Maintenance program is to market and reliably deliver Federal hydroelectric power with preference to public bodies and cooperatives. This is accomplished by maximizing the use of Federal assets to repay the Federal investment and participating with other water resource users in an effort to balance their diverse interests with power needs within broad parameters set by the U.S. Army Corps of Engineers (Corps), and implementing public policy.

Benefits

Southwestern's appropriation supports DOE's Energy Strategic Theme 1, Energy Security by enabling the delivery of reliable, affordable, and environmentally sound energy, and operating a reliable transmission system which is an integral part of the Nation's transmission grid. Southwestern, in conjunction with the Corps, participates in this effort by strategically managing the multipurpose operation of the Federal hydropower system. This enables effective marketing, generation, and delivery of clean, reliable, cost-based electric power.

Southwestern's program provides the Nation numerous benefits, which include:

- Operating a reliable Federal power system in an effective, cost-efficient, and environmentally sound manner while meeting National utility performance standards and balancing the diverse interests of other water resource users,
- Producing power at the lowest cost-based rates possible, consistent with sound business practices,
- Repaying the American taxpayers' investments in the Federal power system,
- Delivering reliable power to its customers,
- Providing economic benefits to the region,
- Providing regional power restoration assistance to other non-hydropower generation sources during power grid emergencies,
- Repaying the costs of operation of the Federal hydropower system with revenues from power customers,
- Complying with the North American Electric Reliability Corporation (NERC) requirements, and
- Complying with the Federal Energy Regulatory Commission requirements consistent with Federal statute.

Annual Performance Results and Targets

Southwestern contributes to the Department's Strategic Theme 1, Energy Security; Strategic Goal 3, Energy Infrastructure; and Secretarial Goal 2, Energy through four subprograms (Operations and Maintenance, Construction, Purchased Power and Wheeling, and Program Direction) supported by appropriations, appropriations offset by receipts, Federal power receipts, and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances). Southwestern accomplishes this by performing its mission in a manner that promotes maintaining and upgrading its energy infrastructure to ensure reliable and efficient delivery of Federal power, which is an integral part of the Nation's electrical grid. Southwestern is modernizing its energy infrastructure; incrementally improving facilities, increasing transmission capacity where feasible, and enhancing transmission grid reliability to support the rapid changing utility industry, interconnection requests, evolving regional needs, and interest in renewable resources.

Annual Performance Targets and Results

Secretarial Goal 2: Energy: Build a competitive, low-carbon economy and secure America's energy future

GPRA Unit Program Goal: Southwestern Power Administration, Operation and Maintenance - Provide the benefits of Federal power to customers by selling and reliably delivering power from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

<table>
<tr><th>FY PY-3</th><th>FY PY-2</th><th>FY PY-1</th><th>FY PY</th><th>FY CY</th><th>FY BY</th><th>FY BY+1</th><th>FY BY+2</th><th>FY BY+3</th><th>FY BY+4</th></tr>
<tr><th>FY 2006</th><th>FY 2007</th><th>FY 2008</th><th>FY 2009</th><th>FY 2010</th><th>FY 2011</th><th>FY 2012</th><th>FY 2013</th><th>FY 2014</th><th>FY 2015</th></tr>
<tr><td colspan="10">Performance Measure: Meet NERC Control Performance Standards (CPS) of CPS1>100 and CPS2>90 and meet or exceed industry averages. CPS1 measures a generating system's performance at matching supply to changing demand requirements and supporting desired system frequency in one minute increments. CPS2 measures a generating system's performance at limiting the magnitude of generation and demand imbalances in ten minute increments.</td></tr>
<tr><td colspan="10">CPS1</td></tr>
<tr><td>T: 161.8
A: 180.23</td><td>T: 161.81
A: 199.26</td><td>T: >100
A: 199.49</td><td>T: >100
A: 199.98</td><td>T: >100
A:</td><td>T: >100
A:</td><td>T: >100
A:</td><td>T: >100
A:</td><td>T: >100
A:</td><td>T >100
A:</td></tr>
<tr><td colspan="10">CPS2</td></tr>
<tr><td>T: 97.2
A: 99.18</td><td>T: 97.21
A: 99.61</td><td>T: >90
A: 99.82</td><td>T: >90
A: 99.82</td><td>T: >90
A:</td><td>T: >90
A:</td><td>T: >90
A:</td><td>T: >90
A:</td><td>T: >90
A:</td><td>T. >90
A:</td></tr>
<tr><td colspan="10">Performance Measure: Provide power at the lowest possible cost by keeping total operation and maintenance expense per kilowatt-hour generated below the National median for public power. *</td></tr>
<tr><td>T: $0.0136
A: $0.0116</td><td>T: $0.0137
A: $0.0126</td><td>T: $0.0153
A: $0.0130</td><td>T: $0.0620
A: $0.0126</td><td>T: < $0.0620
A:</td><td>T: <$0.0620
A:</td><td>T: <$0.0620
A:</td><td>T: <$0.0620
A:</td><td>T: <$0.0620
A:</td><td>T: <$0.0620
A:</td></tr>
<tr><td colspan="10">*Future year targets will be adjusted based on the actual national median for public power.</td></tr>
<tr><td colspan="10">Performance Measure: Ensure timely repayment of Federal investment in accordance with DOE Order RA 6120.2 by maintaining unpaid investment (UI) equal to or less than the allowable unpaid investment (AUI) (Definition Revised in 2010).</td></tr>
<tr><td>T $1,047,467
A: $28,553,300</td><td>T: $1,010,039
A: $31,359,961</td><td>T: $990,334
A: $65,492,927</td><td>T: $6,223
A: $60,282,026</td><td>T: UI<=$1,023M
A:</td><td>T: UI<=$1,306M
A:</td><td>T: UI<=$1,428M
A:</td><td>T: UI<=$1,541M
A:</td><td>T: UI<=$1,542M
A:</td><td>T: UI<=$1,532M
A:</td></tr>
<tr><td colspan="10">Performance Measure: Effectively operate the transmission system to limit the number of accountable outages to no more than 3 annually.</td></tr>
<tr><td>T: =< 3
A: 1</td><td>T: =< 3
A: 0</td><td>T: =< 3
A: 0</td><td>T: =< 3
A: 0</td><td>T: =< 3
A:</td><td>T: =< 3
A:</td><td>T: =< 3
A:</td><td>T: =< 3
A:</td><td>T: =< 3
A:</td><td>T: =< 3
A:</td></tr>
</table>

Means and Strategies

Southwestern will use various means and strategies to achieve its GPRA Unit Program goal. However, various external factors may impact the ability to achieve this goal. Southwestern also collaborates with others to meet its goal.

Southwestern will implement the following means:

- Achieve and maintain financial integrity.
- Maintain power system reliability.
- Operate the Federal power system effectively and efficiently.
- Provide power at the lowest possible cost.

Southwestern will implement the following strategies:

- Market all available hydropower generated at the Corps multipurpose projects and work with the Corps, states, cooperatives, and municipalities to meet statutory requirements while balancing the interests of other water users.
- Ensure power rates are sufficient to repay all annual operating costs and the Federal investment with interest by conducting annual power repayment studies and submitting rate adjustments to DOE and FERC for approval.
- Meet Southwestern's limited 1200-hour peaking power contractual obligations with necessary purchased power and wheeling through the use of Federal power receipts; alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances); and the Continuing Fund as necessary in years of below-average hydropower generation.
- Utilize the following funding mechanisms: appropriations; appropriations offset by receipts; use of Federal power receipts; and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances).
- Maintain a diverse and knowledgeable workforce through employee training, skills gap analyses, leadership development, retention programs, and aggressive recruitment activities.
- Meet NERC requirements by documenting Southwestern's compliance with the latest NERC standards and performing certification and annual emergency operations training for power system dispatchers.
- Maintain the security of the Federal power system, facilities, and information technology (IT) systems.
- Address changes in the electric utility industry, technology, and workload by moving administrative and indirect positions to direct ("front line") positions as opportunities arise.
- Maximize the capabilities of business systems to improve processes and provide greater efficiency.

These strategies will result in a well-maintained, reliable Federal power system, and an exemplary workforce to operate and maintain the system in the most effective and cost-efficient manner possible.

The following external factors could impact Southwestern's ability to achieve its program goal:

- Southwestern's program goal could be impacted by weather, natural disasters, transmission line constraints, new load patterns, deregulation of the electricity market, changing electric industry organizational structures, equipment failure, Congressional requirements, power markets, revenue factors, additions to other utilities' transmission systems interconnected with the Federal system, and other unforeseen requirements.

Successful collaboration of the Federal hydropower partners is necessary for Southwestern to achieve its program goal. Southwestern coordinates its operational activities with the Corps, customers, competing resources interests, the Southwest Power Pool/Regional Transmission Organization (SPP/RTO), and Congress to provide the most efficient and effective use of Federal assets and to ensure NERC and regional reliability council standards are met.

Validation and Verification

Southwestern routinely conducts various internal reviews, studies, and audits to validate and verify program performance. Southwestern's program also is subject to continuing review by external entities such as Congress, the Government Accountability Office (GAO), the DOE's Inspector General, FERC, the U.S. Environmental Protection Agency, the Office of Personnel Management, the Office of Management and Budget (OMB), DOE, NERC, the regional electric reliability council, and Southwestern's Federal power customers.

Achievement of Southwestern's objectives is evaluated in the context of mission responsibilities and the continued impacts of external factors. Each objective has performance targets that are reported quarterly to DOE. Southwestern establishes a corrective plan of action to improve any performance below established quarterly standards. Measuring performance against these targets indicates whether Southwestern is achieving its objectives.

Operations and Maintenance

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operations and Maintenance (O&M)			
Power Marketing	1,773	1,748	500
Operations	3,575	4,080	3,778
Maintenance	6,194	6,680	8,013
Capitalized Movable Equipment	1,323	1,267	1,385
Subtotal, Operations and Maintenance	12,865	13,775	13,676
Offsetting Collections	0	-5,621	-6,733
Alternative Financing	-9,381	0	-1,537
Total, Operations and Maintenance	3,484	8,154	5,406

Mission

The mission of the Operations and Maintenance subprogram is the cornerstone of Southwestern Power Administration's (Southwestern) total program. This subprogram ensures continued reliability of the Federal power system by replacing aging infrastructure and removing constraints that would impede power flows, thus meeting the expectations of the Energy Policy Act of 2005 (EPACT), the National Energy Policy (NEP), the Department of Energy's (DOE) Strategic Plan, and to comply with the North American Electric Reliability Corporation (NERC) standards. This subprogram fulfills the requirements of Section 5 of the Flood Control Act of 1944 and reflects Southwestern's program goal to provide the benefits of Federal power to its customers by selling and reliably delivering renewable energy from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

Benefits

The activities of the Operations and Maintenance subprogram are critical components in maintaining the reliability of the Federal power system, which are part of the Nation's interconnected generation and transmission system. Through the use of renewable hydroelectric energy, Southwestern makes a meaningful contribution of clean, safe, reliable, affordable, and secure energy to our Nation. EPACT, NEP, and DOE's Strategic Plan reinforce the importance of renewable hydroelectric energy by emphasizing its ongoing significant contribution to the Nation's past, current, and future energy supply and identifies Southwestern's important role meeting electricity demand by supplying cost-based hydroelectric power to its customers. All emphasize the need to repair, maintain, and improve the transmission and generation facilities to ensure reliability of the energy infrastructure.

Consistent with EPACT, Southwestern complies with NERC standards and participates with the Southwest Power Pool/Regional Transmission Organization (SPP/RTO), which reinforces Southwestern's role as part of the Nation's interconnected electric grid. In participation with the SPP/RTO, Southwestern works on regional initiatives to develop renewables in our region. During power grid emergencies, Southwestern also has the capability to provide reliable off-site power to help restore other power generation sources. As demand for the transmission of power increases, the investment in maintaining and improving the Nation's energy infrastructure is critical to the fulfillment of energy security to present and future generations.

Southwestern will use appropriations; appropriations offset by receipts; and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances), with customers and others who provide services or funds to ensure a dependable and reliable Federal power system. Southwestern's authority to use net billing and bill crediting is inherent in the authority provided by the Flood Control Act of 1944, and has been affirmed by the Comptroller General.[a] All funding will be utilized to perform reliability-centered maintenance and upgrades which ensure Southwestern's transmission system is operated in the most reliable and cost-effective manner.

Southwestern's planned Operations and Maintenance projects are subject to change based on unanticipated equipment failure, customer needs, and weather conditions. The realities of maintaining a complex interconnected power system means unforeseen priority projects will arise periodically, causing a reprioritization of planned projects. All projects share the commonality of maintaining, repairing, and improving the aging and deteriorating infrastructure to ensure the reliability of the Federal power system.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Power Marketing	**1,773**	**1,748**	**500**

The Power Marketing activity funds technical and economic studies to support Southwestern's

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[a] Honorable Secretary of the Interior B-125127 (February 14, 1956) available at WL 3064 (Comp. Gen.)

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

transmission planning, water resources, communications, and maintenance activities. Technical and economic studies provide data to analyze and evaluate the impacts of proposed operational changes and decision-making based on cost/benefit analysis. Funding is also required for Southwestern's participation in the SPP/RTO and to provide regional power restoration assistance to other non-hydropower generation sources during power grid emergencies. The National Electric Transmission Congestion Study identified constraints in the Nation's interconnected electrical grid which could impede power flows. Studies to identify any constraints on Southwestern's system will continue to be conducted. These studies show how the marketing and delivery of power is operationally impacted. The funding level for this activity is derived from Southwestern's engineering plan, negotiated architect/engineering contracts, and the number of studies required per year. The decrease in funding reflects a reduction in studies being conducted.

Operations **3,575** **4,080** **3,778**

The Operations activity funds communication activities associated with the dispatch and delivery of power; environmental, safety, and health activities; and other transmission activity costs such as physical security, cyber security, and day-to-day power dispatch functions.

- **Communications** **2,349** **2,942** **2,615**

This subactivity funds telemetering improvements, technical support to protect cyber infrastructure, SCADA/EMS maintenance agreements, an e-tagging system that electronically schedules power for customers, load forecasting, digital test equipment, fee for spectrum, and supplies and materials. The telemetering improvements include replacement of obsolete power and energy accounting equipment and modification of existing remote terminal units that improve the reliability of the power system, specifically in the areas of monitoring and control. Funding is required for upgrades that enable Southwestern to meet the goals of the EPACT, NEP, NERC, and DOE's Strategic Plan by replacing deteriorating infrastructure while assuring reliability and continuing to actively participate in the SPP/RTO. The funding level for communications maintenance is derived from maintenance history, the age of equipment, expected life span, annual diagnostic maintenance testing, and historical pricing information. The decrease in funding for this subactivity reflects a reduction in the amount of telemetering upgrades for FY 2011.

- **Environmental, Safety, and Health** **995** **835** **835**

This subactivity funds environmental activities including waste disposal/clean-up of oil and polychlorinated biphenyl contaminates from old circuit breakers and transformers, environmental assessments for threatened and endangered species, property transfers, wetland assessments, environmental library access, Toxic Substance Control Act and Resource Conservation Recovery Act compliance, contractor services, and requirements of the Environmental Protection Program as identified in DOE Order 450.1. The Safety and Health Program activities require funding for aviation safety, industrial hygiene, medical examinations, medical officer, wellness program, safety equipment, and first aid supplies.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
▪ **Other Transmission**	**231**	**303**	**328**

This subactivity funds physical security, field utility costs, and day-to-day power expenses of the dispatch center. The increase in funding for this subactivity reflects additional physical security requirements.

Maintenance	**6,194**	**6,680**	**8,013**

The Maintenance activity funds routine repair, maintenance, and improvement of Southwestern's 25 substations/switchyards and 1,380 miles of high-voltage transmission lines, and ensures delivery of reliable, efficient, and clean power to its customers. Southwestern's initial facilities, which were built approximately 60 years ago, are constantly evaluated. The funding level is derived from age of equipment, risk of failure, life cycle of equipment, and through field crew evaluation. Internal and external factors include obsolescence of technology and lack of replacement parts. This budget request reflects Southwestern's assessment of the funding required to ensure continued reliability of the Federal power system and to fulfill the NERC operational criteria. By replacing aging equipment and removing constraints that impede power flows, Southwestern is meeting the expectations of the National Transmission Grid Study, the Administration's initiative to provide energy efficiencies, and DOE's Secretarial priority to provide clean, secure energy.

▪ **Substation Maintenance**	**4,838**	**5,271**	**6,455**

This subactivity funds a transformer, power circuit breakers, disconnect switches, protective relays and related equipment, computer aided drafting and design, revenue meters, vehicle maintenance, fuel, and other equipment to reliably perform general maintenance projects while maintaining the Federal power system as required by Southwestern's participation in a regional electric reliability council and to comply with NERC requirements. The funding level for this subactivity is derived from an internal maintenance information system, which includes age and condition of the existing equipment. The request also funds the purchase and installation of a new power transformer. The transformer is required to maintain reliability of the power system while accommodating increased loads on the Federal power system resulting from interconnection and open access requests from other utilities. The increase in funding for this subactivity reflects additional relay and disconnect switch replacements.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
▪ **Transmission Line Maintenance**	**1,356**	**1,409**	**1,558**

This subactivity funds the purchase and maintenance of wood and steel structures, crossarms and braces, right-of-way (ROW) clearing, herbicide application, aerial patrol of the transmission system to identify maintenance needs, routine vehicle repair and maintenance, tractor-trailers, heavy equipment, and fuel. The number of steel or wood poles and crossarms and high-voltage insulators is derived from an internal maintenance information system. Emphasis continues to be placed on ROW clearing since NERC identified improper/insufficient ROW clearing as a major factor in potential blackouts. The funding level is appropriate for the number of structures and components to be replaced and the miles of ROW to be cleared as set forth by Southwestern's maintenance plans in meeting the goals of the EPACT, NEP, and NERC to maintain a reliable transmission system. The increase in funding reflects additional purchases of poles to restock pole inventory.

	FY 2009	FY 2010	FY 2011
Capitalized Moveable Equipment	**1,323**	**1,267**	**1,385**

The Capitalized Movable Equipment activity funds the replacement of vehicles, tractor-trailers, and heavy equipment used for maintenance and repair of the transmission system and facilities. The replacement criteria Southwestern utilizes for specialized equipment needed to maintain 1,380 miles of transmission line is derived from the General Services Administration (GSA) and DOE guidelines based on operation duration and age. These vehicles exceed their useful lives and require high levels of maintenance. The vehicle cost estimates are derived from GSA pricing schedules. The increase in funding for this activity reflects the number and/or type of vehicles being purchased.

	FY 2009	FY 2010	FY 2011
Total, Operations and Maintenance	**12,865**	**13,775**	**13,676**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Power Marketing	
The reduction in funding reflects a fewer number of studies being performed.	-1,248
Operations	
▪ **Communications**	
The decrease in funding for this subactivity reflects a reduction in the amount of telemetering upgrades.	-327
▪ **Other Transmission**	
The increase in funding for this subactivity reflects physical security enhancements.	+25
Maintenance	

	FY 2011 vs. FY 2010 ($000)
- **Substation Maintenance** The increase in funding for this subactivity reflects the purchase of a transformer and the escalation of replacing relays and disconnect switches to ensure system reliability.	+1,184
- **Transmission Line Maintenance** The increase in funding reflects additional purchases of poles to restock pole inventory.	+149
Capitalized Movable Equipment	
Increase reflects the number and/or type of vehicles being purchased.	+118
Total Funding Change, Operations and Maintenance	**-99**

Construction

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Construction			
Transmission System	5,991	6,016	8,073
Subtotal, Construction	5,991	6,016	8,073
Alternative Financing	-3,191	-2,000	-2,000
Total, Construction	2,800	4,016	6,073

Mission

The mission of the Construction subprogram is to ensure continued reliability of the Federal power system by providing for additions, modifications, replacements, and interconnections to the transmission, substation, and communication facilities, thus meeting the expectations of the Energy Policy Act of 2005 (EPACT), the National Energy Policy (NEP), the Department of Energy's (DOE) Strategic Plan, and to comply with the North American Electric Reliability Corporation (NERC) standards. This subprogram fulfills the requirements of Section 5 of the Flood Control Act of 1944 and reflects Southwestern Power Administration's (Southwestern) program goal to provide the benefits of Federal power to its customers by selling and reliably delivering renewable energy from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

Benefits

The activities of the Construction subprogram enable Southwestern to market and deliver Federal hydropower in the most reliable, safe, efficient, and cost-effective manner to meet the operational criteria required by NERC and as a participant in the National electrical grid while avoiding transmission infrastructure deterioration. EPACT, NEP, and DOE's Strategic Plan reinforce the importance of renewable hydroelectric energy by emphasizing its ongoing significant contribution to the Nation's past, present, and future energy supply and Southwestern's important role meeting electricity demand by supplying cost-based hydroelectric power to its customers. Southwestern's participation in the Southwest Power Pool/Regional Transmission Organization (SPP/RTO), reinforces Southwestern's role as an integral part of the Nation's interconnected generation and transmission system. In participation with the SPP/RTO, Southwestern works on regional initiatives to develop renewables in our region. As the demand for the transmission of power increases, the investment in improving the Nation's energy infrastructure, by providing improvements, replacements, and interconnections, is critical in assuring reliable delivery of power, fulfilling energy security for the present as well as for future generations.

Southwestern will continue to use appropriations and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances), with customers and others who provide services or funds to ensure a dependable and reliable Federal power system. Southwestern's authority to use net billing and bill crediting is inherent in the authority provided by the Flood Control Act of 1944, and has been affirmed by the Comptroller General.[a] All funding will be utilized to perform reliability-centered upgrades and additions which ensure Southwestern's transmission system is operated in the most reliable and cost-effective manner.

Southwestern's planned Construction projects are subject to change based on unanticipated equipment failure, customer needs, and weather conditions. The realities of maintaining a complex interconnected power system means unforeseen priority projects will arise periodically, causing a reprioritization of planned projects. All projects share the commonality of replacing aging and deteriorating infrastructure necessary to maintain the reliability of the Federal power system.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Transmission System	**5,991**	**6,016**	**8,073**

This activity funds all construction projects that require expansion of or additions to existing facilities. System reliability is ensured by replacing aging and deteriorating equipment, thereby removing constraints that limit power flows. The projects reflect Southwestern's efforts to reduce the risk of extended service outages, avoid more costly replacements in the future, and support the increased transmission system usage. The funding level for this activity is derived from internal and external management decisions and field crew observations regarding system age, risk of equipment failure, life cycles, obsolescence of technology, availability of spare parts, budget constraints, cost, and demand for more capacity. These variables are assessed and incorporated into Southwestern's ten-year construction plan.

▪ **Substation Upgrades**	**2,200**	**0**	**0**

This subactivity funds a high priority upgrade of the station bus and associated equipment at the Bull Shoals Dam switchyard that has been identified by the SPP/RTO as necessary to relieve a transmission constraint. The Bulls Shoals upgrade was completed in FY 2009 and no other projects have been identified for FY 2011.

▪ **Communication Equipment**	**3,791**	**5,840**	**3,575**

This subactivity funds all communication equipment and microwave radio and tower replacements that are planned to provide improved system reliability and reduce future maintenance and equipment costs. This subactivity also provides funding for microwave radios and microwave tower additions, replacements, and modifications that will allow Southwestern to complete an important communication ring within its network that will increase the reliability of communications with the generating plants and substations in the Oklahoma region. The communication system provides for the transfer of voice

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[a] Honorable Secretary of the Interior B-125127 (February 14, 1956) available at WL 3064 (Comp. Gen.)

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

and data traffic to allow monitoring and control of power system generation and transmission assets. The reduction in funding reflects a fewer number of planned microwave radio and tower replacements.

In December 2004, the Congress passed and the President signed the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494), creating the Spectrum Relocation Fund (SRF) to streamline the relocation of Federal systems from existing spectrum bands to accommodate commercial use by facilitating reimbursement to affected agencies of relocation costs. Southwestern has received $25.8 million in spectrum relocation funds, as approved by the Office of Management and Budget, and as reported to the Congress. These funds are mandatory and will remain available until expended, and agencies will return to the SRF any amounts received in excess of actual relocation costs. Frequency spectrum activities were funded from spectrum auction proceeds; thus, no funding is provided in this subactivity.

	FY 2009	FY 2010	FY 2011
▪ **Transmission Upgrades**	**0**	**176**	**4,498**

This subactivity funds transmission system upgrades. Southwestern's transmission lines are reaching the intended service life of 45 years and are in need of repair and upgrading. During the ice storm of 2009, an additional 30 miles of transmission line were identified as being in critical need of replacement. The additional stress to the transmission line, caused by the ice storm, has further deteriorated the line which is nearing its service life of 45 years. Southwestern will use this opportunity to increase the capacity of the line to provide more reliable service to the interconnected transmission system, thereby increasing energy efficiency. Funding will also be utilized to replace approximately 39 miles of severely corroded and worn shield wire on the transmission line to protect the current-carrying conductors from damage due to lightning strikes. The increase in funding reflects greater emphasis being placed on transmission line repair and upgrade.

	FY 2009	FY 2010	FY 2011
Total, Construction	**5,991**	**6,016**	**8,073**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Transmission System	
▪ **Communication Equipment** The reduction in funding reflects a fewer number of planned microwave radio and tower replacements to accommodate needed transmission line repair and upgrade.	-2,265
▪ **Transmission Upgrades** The increase in funding reflects an emphasis on repairing and upgrading approximately 30 miles of transmission line and replacing worn shield wire.	+4,322
Total Funding Change, Construction	**+2,057**

Purchased Power and Wheeling

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Purchased Power and Wheeling (PPW) [a]			
System Support	42,500	44,500	45,500
Other Contractual Services	3,500	3,500	3,500
Total, PPW	46,000	48,000	49,000
Use of Alternative Financing – Reimbursable Authority (customer advances), Net Billing, Bill Crediting:			
Purchased Power	-7,725	-6,725	-6,725
Wheeling	-3,275	-3,275	-3,275
Total, Alternative Financing	-11,000	-10,000	-10,000
Subtotal, Purchased Power and Wheeling	35,000	38,000	39,000
Offsetting Collections	-35,000	-38,000	-39,000
Total, Purchased Power and Wheeling	0	0	0

Mission

The mission of the Purchased Power and Wheeling (PPW) subprogram is to provide for the purchase of energy to meet limited peaking power contractual obligations and the delivery of Federal power. Such purchases are blended with the available Federal hydroelectric power and energy to provide a more beneficial and reliable product while assuring repayment of the Federal investment plus interest, thus meeting the expectations of the Energy Policy Act of 2005 (EPACT), the National Energy Policy (NEP), the Department of Energy's (DOE) Strategic Plan, and to comply with the North American Electric Reliability Corporation (NERC) standards. This subprogram fulfills the requirements of Section 5 of the Flood Control Act of 1944 and reflects Southwestern Power Administration's (Southwestern) program goal to provide the benefits of Federal power to its customers by selling and reliably delivering renewable energy from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

Benefits

The activities of the PPW subprogram provide for the purchase of energy to meet limited peaking power contractual obligations to ensure the marketability of the Federal resource and repayment of the Federal investment. Southwestern's power sales contracts provide for only 1200 hours of peaking power per year, representing a portion of its customers' firm load requirements. The customers provide their own resources and/or purchases for the remainder of their firm loads. This subprogram also provides for wheeling services that deliver Federal power to optimize the operation of the hydroelectric facilities marketed by Southwestern. EPACT, NEP, NERC, and DOE's Strategic Plan reinforce the importance of domestic, renewable hydroelectric energy by emphasizing its ongoing significant contribution to the Nation's past, present, and future energy supply and identifies Southwestern's important role meeting electricity demand by supplying cost-based hydroelectric power to its customers. This subprogram enhances the reliability of the electrical transmission grid.

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[a] Southwestern's budget request for the Purchased Power and Wheeling subprogram reflects anticipated needs to ensure adequate funding to fulfill its 1200-hour peaking power contractual obligations based on volatile market prices, limited availability of energy banks, and all but the most severe hydrological conditions.

The reduced level of energy banking available from other electric utilities requires Southwestern to use alternative financing to fund power deliveries. Southwestern will continue to use Federal power receipts and alternative financing methods, including net billing, bill crediting, and/or reimbursable authority (customer advances), to fund this subprogram. When hydro generation is significantly below normal due to severe drought conditions, Southwestern will utilize the Continuing Fund for emergency PPW expenses.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
System Support	**42,500**	**44,500**	**45,500**

This activity funds purchased power requirements that fulfill all 1200-hour contractual peaking power obligations with customers. Southwestern will continue to use Federal power receipts and alternative financing methods, including net billing, bill crediting, and/or reimbursable authority (customer advances), to meet purchased power requirements.

System support requirements are affected by weather, volatile market prices, and limited availability of energy banks. For the past 20 years, Southwestern's purchased power requirements have been based on average water conditions, which were established in an effort to reduce unused appropriations during numerous good water years. Beginning in FY 2001, Southwestern received authority from Congress to use offsetting collections to fund power purchases, again based on average water conditions. However, during the FY 2005 and FY 2006 drought, funding problems developed resulting from the limited amount of offsetting collections authorized to fund PPW. Inadequate funding for PPW required constant requests to access the Continuing Fund in order to ensure sufficient funding was available to fulfill Southwestern's 1200-hour peaking power contractual obligations. Southwestern requested, and Congress approved, an increase in authority to use Federal power receipts (offsetting collections) in FY 2008. The use of this increased authority will be dependent upon the hydrological conditions of that fiscal year which, under average conditions, will be approximately half of the authority requested. Since the rates charged to its customers are based on costs, Southwestern has a built-in incentive to minimize its expenditures for purchased power. This additional authority will ensure greater flexibility in times of below average generation and volatile market prices, and will decrease dependence on the Continuing Fund under all but the most severe hydrological conditions. The increase in funding reflects projected market escalation.

Other Contractual Services	**3,500**	**3,500**	**3,500**

This activity funds other contractual services that provide for wheeling associated with the purchase of transmission service to meet limited peaking power obligations and for the integration of projects for the delivery of Federal power. The funding level for this activity is derived from contractual wheeling

	(dollars in thousands) FY 2009	FY 2010	FY 2011

requirements. Southwestern will continue to use Federal power receipts and alternative financing methods, including net billing, bill crediting, and/or reimbursable authority (customer advances), to meet wheeling requirements. The FY 2011 funding request reflects the projected cost for wheeling services based on contractual pricing and delivery terms.

	FY 2009	FY 2010	FY 2011
Total, Purchased Power and Wheeling	**46,000**	**48,000**	**49,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
System Support	
- Increase in system support reflects anticipated needs based on projected increase in market prices.	+1,000
Other Contractual Services	0
Total Funding Change, Purchased Power and Wheeling	**+1,000**

Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)	FY 2009	FY 2010	FY 2011
Program Direction (PD)			
Salaries and Benefits	19,659	21,288	21,958
Travel	847	938	1,045
Support Services	1,718	2,212	2,580
Other Related Expenses	2,106	2,715	2,798
Subtotal, Program Direction	24,330	27,153	28,381
Alternative Financing	-2,200	0	-281
Offsetting Collections	0	-26,247	-26,880
Total, Program Direction	22,130	906	1,220
Full-time Equivalents	179	194	194

Mission

The mission of the Program Direction subprogram is to ensure continued reliability of the Federal power system by utilizing Federal staffing resources and associated funds required to provide overall direction and execution of Southwestern Power Administration's (Southwestern) Operation and Maintenance Program. This subprogram supports the 2005 Energy Policy Act (EPACT), the National Energy Policy (NEP), and the Department of Energy's (DOE) Strategic Plan by providing delivery of reliable, affordable, and environmentally sound energy to the Nation. This subprogram fulfills the requirements of Section 5 of the Flood Control Act of 1944 and reflects Southwestern's program goal to provide the benefits of Federal power to its customers by selling and reliably delivering renewable energy from Federal multipurpose hydroelectric dams at the lowest cost-based rates possible that produce revenues sufficient to repay all power costs to the American taxpayers.

The Departmental Strategic Plan emphasized that DOE's Strategic Goals will be accomplished not only through the efforts of the major program offices in DOE, but also with additional effort from offices which support the programs in carrying out the mission. The Program Direction subprogram provides compensation and all related expenses for 194 Federal personnel who market, deliver, operate, maintain, and administer Southwestern's high-voltage interconnected power system and associated facilities. Southwestern will use appropriations; appropriations offset by receipts; and alternative financing arrangements, including net billing, bill crediting, and/or reimbursable authority (customer advances), with customers and others who provide services or funds to ensure a dependable and reliable Federal power system. Southwestern's authority to use net billing and bill crediting is inherent in the authority provided by the Flood Control Act of 1944, and has been affirmed by the Comptroller General.[a]

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[a] Honorable Secretary of the Interior B-125127 (February 14, 1956) available at WL 3064 (Comp. Gen.)

Southwestern performs critical functions in meeting the challenges of operating and maintaining the Federal power system to ensure reliability, while meeting the growing demand for power and avoiding deterioration of the infrastructure. The functions include participation with entities to develop renewables in our region, managing information technology, ensuring sound legal advice and fiscal stewardship, developing and implementing uniform program policy and procedures, maintaining and supporting our workforce, safeguarding our facilities, and providing Congressional and public liaison.

Southwestern is committed to performing its mission while supporting the President's initiatives to reduce greenhouse gas emissions, reduce oil consumption, and provide economic benefits.

Southwestern's Program Direction subprogram further supports the Human Capital initiative, which is linked with careful planning and administration of the budget, through its Human Capital Management (HCM) Workforce Plan. This linkage is manifested in planning to ensure that funds are available and allocated properly to support the initiative's elements. HCM Workforce Plan requirements include: reducing the number of organizational layers, addressing succession planning, reducing the time to make decisions, redirecting positions to the front lines, improving operational processes, and addressing other key workforce challenges.

By the end of FY 2011, approximately 25 percent of Southwestern's staff will be eligible for retirement. However, Southwestern will retain a strong staff of professionals dedicated to the pursuit of excellence by continuing to invest in its current employees, emphasizing strong development programs, completing skills gap analyses, and pursuing aggressive recruitment and retention efforts as identified in its HCM Workforce Plan.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**19,659**	**21,288**	**21,958**

This activity funds salaries and benefits for 194 skilled Federal employees who market and deliver Federal hydropower by operating and maintaining Southwestern's high-voltage interconnected power system with its associated facilities and providing support for these functions. The funding level for salaries is derived from the current year budgeted salaries plus cost-of-living adjustments, promotions, and within-grade increases. The funding level for benefits is derived from a percentage of budgeted salaries. The benefits for FERS employees are higher than CSRS. As more and more CSRS employees retire, the benefit costs will continue to increase.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

The FY 2011 level supports 194 Federal employees: 54 percent of the employees are General Schedule (GS) and subject to the Administration's proposed cost-of-living adjustment; salaries of the remaining 46 percent (craft workers and power system dispatchers) are determined through union negotiations and wage surveys. This activity also includes overtime, awards, relocation, workers' compensation, recruitment bonuses, retention pay, and advanced in-hire rates. The increase in funding is due to salary and within grade increases, including salaries determined by prevailing rates in the electric utility industry.

	FY 2009	FY 2010	FY 2011
Travel	**847**	**938**	**1,045**

This activity funds all related travel and per diem expenses for mission-related travel to maintain the integrity and reliability of Southwestern's geographically dispersed power system. The funding level for this activity is primarily derived from the daily requirement of the field maintenance personnel to maintain 1,380 miles of transmission line, 25 substations/switchyards, 51 microwave/radio sites, communication equipment, and the Supervisory Control and Data Acquisition network. Travel for the performance of general and administrative functions is also included. The increase in funding for this activity is due to rising per diem costs, GovTrip usage fees, and transportation rates due to increased fuel costs.

	FY 2009	FY 2010	FY 2011
Support Services	**1,718**	**2,212**	**2,580**

This activity funds contracted management support services including information technology, E-Government, and administrative/records management support. The funding level for this activity is derived from the most recent negotiated contract for support services essential to achieve Southwestern's mission. The increase in funding for this activity reflects the terms of the recent negotiated contract.

	FY 2009	FY 2010	FY 2011
Other Related Expenses	**2,106**	**2,715**	**2,798**

This activity funds rental space, facility security, financial audit, services of the Power Marketing Liaison Office, working capital fund, technology refresh in the areas of personal computers, hardware and software, printing and reproduction, and training and tuition fees in support of workforce planning and required training to meet the North American Electric Reliability Corporation (NERC) emergency operations requirement. Rental space costs assume the GSA inflation factor. Other costs are based on the historical usage and actual cost of similar items. The increase in funding for this activity is primarily due to additional training and the financial audit.

	FY 2009	FY 2010	FY 2011
Total, Program Direction	**24,330**	**27,153**	**28,381**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits	
▪ Increase reflects survey-based wage determinations, union-negotiated and Administratively Determined pay adjustments, and salary and within grade increases.	+670
Travel	
▪ The increase in funding for this activity is due to rising per diem costs, GovTrip usage fees, and transportation rates due to increased fuel costs.	+107
Support Services	
▪ Increase reflects funding for support services per the recent negotiated contract.	+368
Other Related Expenses	
▪ Increase in funding for this activity is primarily due to increased training and the financial audit.	+83
Total Funding Change, Program Direction	**+1,228**

Support Services by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Management Support			
Reports and Analysis Management and General Administrative Services	1,718	2,212	2,580
Subtotal, Management Support	1,718	2,212	2,580
Total, Support Services	1,718	2,212	2,580

Other Related Expenses by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Training	178	190	200
Printing and Reproduction	49	49	50
Rent to Others	691	705	700
Employee Parking	83	84	85
Financial Audit	294	364	382
Power Marketing Liaison Office	140	140	140
Supplies and Materials	177	200	200
Working Capital Fund	88	160	160
Equipment	98	100	100
Other	308	723	781
Total, Other Related Expenses	2,106	2,715	2,798

Revenues and Receipts

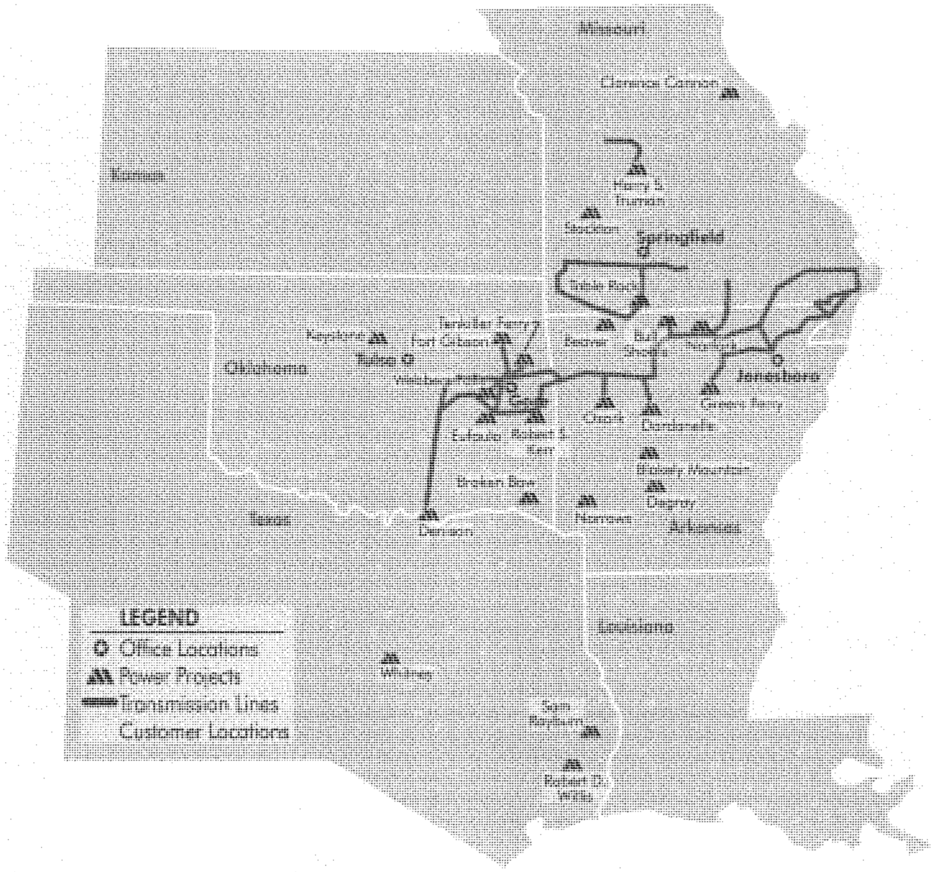
(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Gross Revenues							
Sale and Transmission of Electric Energy	181,987	196,900	204,500	205,600	207,400	208,400	209,400
Total, Gross Revenues	181,987	196,900	204,500	205,600	207,400	208,400	209,400
Alternative Financing Credited as an Offsetting Receipt, Net Billing/Bill Crediting	-52,499	-57,400	-58,400	-59,400	-60,400	-61,500	-62,500
Offsetting Collections, Southwestern							
Annual Expenses (Net Zero)	0	-31,868	-33,613	-35,100	-36,399	-37,671	-37,890
Offsetting Collections Realized, Purchased Power and Wheeling	-1,550	-38,000	-39,000	-40,000	-41,000	-42,000	-43,000
White River Minimum Flows Legislation	0	-40,000	0	0	0	0	0
Adjustments not otherwise Classified	4,873	0	0	0	0	0	0
Continuing Fund Usage for PPW	-12,979	0	0	0	0	0	0
Total Proprietary Receipts	119,832	29,632	73,487	71,100	69,601	67,229	66,010
Percent of Sales to Preference Customers	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Energy Sales from Power Marketed (billions of kilowatt hours)	5.4	5.4	5.4	5.4	5.4	5.4	5.4

System Statistics

	FY 2009 Actual	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate
Generating Capacity (kilowatts)							
Installed Capacity	2,173,800	2,173,800	2,173,800	2,173,800	2,173,800	2,173,800	2,173,800
Peak Capacity	2,052,500	2,052,500	2,052,500	2,052,500	2,052,500	2,052,500	2,052,500
Generating Stations							
Generating Projects (Number)	24	24	24	24	24	24	24
Substations/Switchyards (Number)[a]	25	25	25	25	25	25	25
Substations/Switchyards (kVA Capacity)	1,026,900	1,026,900	1,026,900	1,026,900	1,026,900	1,026,900	1,026,900
Available Energy (Megawatt-hours)							
Energy Generated	6,263,469	5,444,100	5,415,000	5,412,700	5,412,700	5,412,700	5,412,700
Energy Received	58,528	188,100	209,000	209,700	209,700	209,700	209,700
Total, Energy Available for Marketing	6,321,997	5,632,200	5,624,000	5,622,400	5,622,400	5,622,400	5,622,400
Transmission Lines (Circuit-Miles)							
161-KV	1,117	1,117	1,117	1,117	1,117	1,117	1,117
138-KV	164	164	164	164	164	164	164
69-KV	99	99	99	99	99	99	99
Total, Transmission Lines	1,380	1,380	1,380	1,380	1,380	1,380	1,380

System Map


Missouri
Clarence Cannon
Kansas
Harry S. Truman
Stockton
Springfield
Table Rock
Keystone
Tenkiller Ferry
Fort Gibson
Oklahoma
Tulsa
Webbers Falls
Beaver
Bull Shoals
Norfork
Jonesboro
Greers Ferry
Ozark
Dardanelle
Eufaula
Robert S. Kerr
Blakely Mountain
Broken Bow
Narrows
DeGray
Arkansas
Texas
Denison
Louisiana
Whitney
Sam Rayburn
Robert D. Willis
LEGEND
Office Locations
Power Projects
Transmission Lines
Customer Locations

Power Marketed, Wheeled, or Exchanged by Project

	State	Number of Plants	Installed Capacity (kW)	FY 2009 Actual Energy (GWh)	FY 2010 Estimated Energy (GWh)	FY 2011 Estimated Energy (GWh)	FY 2012 Estimated Energy (GWh)	FY 2013 Estimated Energy (GWh)	FY 2014 Estimated Energy (GWh)	FY 2015 Estimated Energy (GWh)
Power Marketed Interconnected System	Missouri	4	463,200	2,160	1,849	1,846	1,846	1,845	1,845	1,845
	Arkansas	9	1,037,100	1,192	1,020	1,019	1,018	1,018	1,018	1,018
	Oklahoma	7	514,100	1,311	1,123	1,121	1,121	1,121	1,121	1,121
	Texas	2	100,000	543	465	465	465	465	465	465
	Louisiana	0	0	437	375	374	374	374	374	374
	Kansas	0	0	485	416	415	415	415	415	415
Subtotals		22	2,114,400	6,128	5,248	5,240	5,239	5,238	5,238	5,238
Isolated:										
Robert D. Willis Project										
Sam Rayburn Project										
50% to Texas		2	59,400	28	76	76	76	76	76	76
50% to Louisiana		0	0	28	76	76	76	76	76	76
Subtotals		2	59,400	56	152	152	152	152	152	152
Total, Power Marketed		24	2,173,800	6,184	5,400	5,392	5,391	5,390	5,390	5,390
Power Wheeled/Exchanged										
Wheeled (MW)				1,177	1,273	1,293	1,305	1,305	1,305	1,305
Exchanged (GWh)				34	0	0	0	0	0	0

Western Area Power Administration

Construction, Rehabilitation, Operation and Maintenance
Western Area Power Administration

Proposed Appropriation Language

For carrying out the functions authorized by title III, section 302(a)(1)(E) of the Act of August 4, 1977 (42 U.S.C. 7152), and other related activities including conservation and renewable resources programs as authorized, including official reception and representation expenses in an amount not to exceed $1,500; [$256,711,000] *$285,864,000* to remain available until expended, of which [$245,216,000] *$277,430,000* shall be derived from the Department of the Interior Reclamation Fund: *Provided*, That notwithstanding 31 U.S.C. 3302, section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), and section 1 of the Interior Department Appropriation Act, 1939 (43 U.S.C. 392a), up to [$147,530,000] *$180,306,000* collected by the Western Area Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended, for the sole purpose of funding the annual expenses of the Western Area Power Administration: *Provided further*, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year [2010] *2011* appropriation estimated at not more than [$109,181,000] *$105,558,000*, of which [$97,686,000] *$97,124,000* is derived from the Reclamation Fund: *Provided further*, That of the amount herein appropriated, [$7,584,000] *$7,627,000* is for deposit into the Utah Reclamation Mitigation and Conservation Account pursuant to title IV of the Reclamation Projects Authorization and Adjustment Act of 1992: *Provided further*, That notwithstanding 31 U.S.C. 3302, up to [$349,807,000] *$350,919,000* collected by the Western Area Power Administration pursuant to the Flood Control Act of 1944 and the Reclamation Project Act of 1939 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures[: *Provided further*, That of the amount herein appropriated, up to $18,612,000 is provided on a nonreimbursable basis for environmental remediation at the Basic Substation site in Henderson, Nevada: *Provided further*, That notwithstanding 31 U.S.C. 3302, section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), and section 1 of the Interior Department Appropriation Act, 1939 (43 U.S.C. 392a), funds collected by the Western Area Power Administration from the sale of power and related services that are applicable to the repayment of the annual expenses of this account in this and subsequent fiscal years shall be credited to this account as discretionary offsetting collections for the sole purpose of funding such expenses, with such funds remaining available until expended]: *Provided further*, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses). (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

Explanation of Change

Permanent language enacted in FY 2010 reclassifying receipts associated with annual expenses is removed; the language does not require reenactment to remain in effect. Language providing nonreimbursable appropriations for environmental remediation at the Basic Substation site is removed.

Falcon and Amistad Operating and Maintenance Fund

Proposed Appropriation Language

For operation, maintenance, and emergency costs for the hydroelectric facilities at the Falcon and Amistad Dams, [$2,568,000] *$3,715,000*, to remain available until expended, and to be derived from the Falcon and Amistad Operating and Maintenance Fund of the Western Area Power Administration, as provided in section 2 of the Act of June 18, 1954 (68 Stat. 255) as amended: *Provided,* That notwithstanding the provisions of that Act and of 31 U.S.C. 3302, up to [$2,348,000] *$3,495,000* collected by the Western Area Power Administration from the sale of power and related services from the Falcon and Amistad Dams shall be credited to this account as discretionary offsetting collections, to remain available until expended for the sole purpose of funding the annual expenses of the hydroelectric facilities of these Dams and associated Western Area Power Administration activities: *Provided further,* That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year [2010] *2011* appropriation estimated at not more than $220,000[: *Provided further*, That notwithstanding the provisions of section 2 of the Act of June 18,1954(68 Stat. 255), as amended, and 31 U.S.C. 3302, all funds collected by the Western Area Power Administration from the sale of power and related services from the Falcon and Amistad Dams that are applicable to the repayment of the annual expenses of the hydroelectric facilities of these Dams and associated Western Area Power Administration activities in this and subsequent fiscal years shall be credited to this account as discretionary offsetting collections for the sole purpose of funding such expenses, with such funds remaining available until expended]: *Provided further,* That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred. (*Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Explanation of Change

Language removed speaks to reclassification of the receipts associated with annual expenses from mandatory to discretionary and sets forth the use of these receipts to offset the appropriations for annual expenses as first approved in the 2010 appropriation language.

Western Area Power Administration
Overview
Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Western Area Power Administration				
Construction, Rehabilitation, Operation and Maintenance (CROM)	901,634	10,000 [a]	899,317	912,890
Less use of alternative financing [b]	-276,804	0	-288,920	-271,895
Offsetting collections from Colorado River Dam Fund (P.L. 98-381)	-3,366	0	-3,879	-4,212
Offsetting collections, annual Operation and Maintenance and Program Direction expenses	0	0	-147,530	-180,306
Offsetting collections, Purchase Power and Wheeling expenses	-403,118	0	-349,807	-350,919
Total, CROM	218,346	10,000	109,181	105,558
Falcon and Amistad Operating and Maintenance Fund (Falcon and Amistad)	2,959	0	2,568	3,715
Offsetting collections, annual operation and maintenance expenses	0	0	-2,348	-3,495
Total, Falcon and Amistad	2,959	0	220	220
Colorado River Basins Power Marketing Fund (CRBPMF) operating expenses	240,284	0	261,723	227,303
Offsetting collections realized	-263,284	0	-284,723	-250,303
Total, CRBPMF	-23,000	0	-23,000	-23,000
Total, Western Area Power Administration	198,305	10,000	86,401	82,778
Reclassification of Mandatory Receipts to Discretionary Offsetting Collections	0	0	+149,878	0

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[a] $10,000,000 was enacted in the American Recovery and Reinvestment Act of 2009 for Western to implement activities authorized in Section 402 of the Act.

[b] FY 2009, FY 2010, and FY 2011 CROM funding amounts include $197,842,000, $199,040,000, and $192,703,000 respectively, for planned alternative financing of the PPW subprogram; including use of Western's Continuing Fund as necessary to respond to below normal hydropower generation conditions. In addition, the FY 2009, FY 2010, and FY 2011 CROM funding amounts include $78,962,000, $89,880,000, and $79,192,000 respectively, for planned alternative financing of Western's Construction & Rehabilitation, Operation & Maintenance and Program Direction subprograms.

Preface

The Department of Energy (DOE) leads a critical effort to build a competitive, low-carbon economy and secure America's energy future in promoting a diverse supply of reliable, affordable, environmentally-sound energy. Western Area Power Administration (Western), in conjunction with the U.S. Army Corps of Engineers (Corps), U.S. Bureau of Reclamation (BOR) and the Department of State's International Boundary and Water Commission (IBWC), strongly supports this effort in managing the multipurpose operation of the Federal hydropower system to reliably deliver renewable energy across a high-voltage, integrated transmission system.

Within the three appropriation accounts (e.g. Construction, Rehabilitation, Operation and Maintenance Account (CROM), the Falcon and Amistad Operating and Maintenance Fund, and the Colorado River Basins Power Marketing Fund (CRBPMF)), there is one program: the Western Area Power Administration. Within Western, there are a total of eight subprograms; five in the CROM Account, one in the Falcon and Amistad Operating and Maintenance Fund and two in CRBPMF. Consistent with the authority provided in the 2010 Energy and Water Appropriations, the FY 2011 Budget provides funding for the annual expenses (operation and maintenance and program direction) through discretionary offsetting collections derived from power receipts collected to recover those expenses.

Mission

Western markets and delivers reliable, cost-based Federal hydroelectric power and related services throughout the central and western United States.

Benefits

Western's marketing efforts and delivery capability span a 1.3-million-square-mile area serving a diverse group of approximately 665 wholesale customers, including municipalities, cooperatives, public utility and irrigation districts, Federal and State agencies and Native American tribes. In turn, wholesale power is used to provide service to millions of retail consumers.

American Recovery and Reinvestment Act (Recovery Act)

- The American Recovery and Reinvestment Act of 2009 provided Western $10 million in nonreimbursable appropriations to implement activities authorized in section 402 of the Act.
- The Act provided Western borrowing authority for constructing, financing, facilitating, planning, operating, maintaining or studying construction of new or upgraded electric power transmission lines and related facilities with at least one terminus within the area served by Western; and for delivering or facilitating the delivery of power generated by renewable energy resources constructed or reasonably expected to be constructed after the date of enactment. This authority to borrow from the U.S. Treasury is available to Western on a permanent, indefinite basis, with the amount of borrowing not to exceed $3.25 billion at any one time. Western established a separate program and office to administer borrowing authority and to comply with the transparency and reporting requirements established under the Act. The new Transmission Infrastructure Program will support both Western and DOE priorities by facilitating the delivery of renewable energy resources to market.

Performance

Western, through its three appropriation accounts indentified above, contributes to the Secretary's Energy Goal to build a competitive, low-carbon economy and secure America's energy future, by performing its mission in a manner that promotes development of higher capacity U.S. energy infrastructure to ensure flexible, reliable operations and efficient energy markets. Specifically, Western is modernizing its energy infrastructure, incrementally improving facilities to increase transmission capacity and enhance grid reliability to support continuing utility industry change, requests for interconnection to the Federal system and evolving regional needs and increasing interest in renewable resources. Western also jointly plans, develops, and finances system enhancements, encouraging partnerships for transmission development by fostering cooperation and economic coordination among transmission partners.

Means and Strategies

Western will use various means and strategies outlined below to achieve its GPRA Unit Program Goal to ensure customers continue to receive the maximum benefit from Federal resources. Although various external factors may impact Western's ability to achieve this goal, through the collaborative support of our Federal power partners, Western will continue to market and deliver cost-based, high-value power products and services that support Department efforts to ensure America's energy future.

Western will implement the following means:

- Improve the capability, performance and reliability of the integrated grid through technology and equipment enhancements.
- Strengthen ability to participate in large-scale transmission projects to improve Western's transmission infrastructure, maintain or enhance system reliability, support customer projects and increase the overall effectiveness of the nation's integrated grid.
- Improve workforce organizational capabilities and employee skills; hiring, training, and retaining a high-performing team to carry out the agency's mission.
- Operate the Federal power system efficiently, updating power system operation technologies to maintain required industry reliability standards and compliance.
- Conduct business process reviews to maximize organizational capabilities, improve organizational efficiency and better align or design the agency to meet growing demands in complying with transmission service commitments and energy policy requirements.

Western will continue to implement the following strategies:

- Ensure efficient transmission system operations to support the Nation's integrated power grid.
- Maintain and modernize systems and infrastructure to increase the reliability, efficiency, and use of Federal assets.
- Use sound business practices and prudent risk management in the conduct of agency activities and operations.
- Meet the increasing demands on maintenance for our aging infrastructure, from transmission growth and evolving transmission and regulatory reliability compliance standards.
- Manage power delivery costs.
- Participate in decision-making processes with natural resource agencies and others where decisions will affect Federal hydropower generation.
- Participate in reliability and restructuring initiatives in Federal, state and industry forums and transmission studies, as an advocate for customer benefits.
- Continue to provide open access to Western's transmission system in furthering industry restructuring and to support local/regional utilities in the delivery of electricity to their customers.

These strategies will result in a well-maintained, reliable Federal power system, and an exemplary workforce to operate and maintain the system in the most efficient and cost effective manner possible.

The following external factors may affect Western's ability to achieve its goal: Generally, system reliability can be affected by weather, natural disasters, changes in North American Electric Reliability Corporation (NERC) operating standards, industry deregulation, changing electric industry organizational structures, interconnections, open access and the lack of adequate funding resources. More specifically:

- The Nation's energy infrastructure is not keeping pace with the growth in energy supply and demand, thereby endangering the reliability of the integrated electrical system.
- Western's transmission infrastructure continues to age, despite an ongoing replacement program.
- A number of states have adopted aggressive Renewable Portfolio Standards calling for the integration of renewable resources into the Nation's energy mix further straining the grid.
- Grid operations are becoming more complex.
- Many of the best sites for these renewable generating sources--wind, solar and biomass--are located in parts of the West and Midwest that are not near load centers, and many of the nearby transmission lines lack available capacity to transport this energy.
- Industry efforts to improve the reliability of the bulk power grid are placing more requirements on our workforce to implement mandatory reliability standards.
- Our highly-skilled technical workforce continues to age and we are competing with the rest of the electric utility industry to attract and retain the caliber of workforce needed to provide reliable power supply and transmission services.

Successful collaboration on program activities among Federal partners, including the Corps, BOR, IBWC, customers, and regional utilities, is necessary for Western to achieve its goal to market and reliably deliver Federal power to customers, and to provide for the most efficient use of Federal assets and resources.

Validation and Verification

Western's performance results are validated and verified annually by an independent accounting firm as part of the Department's annual financial statement audit. The power supply and delivery reliability measures are also benchmarked against NERC operating standards for the electric utility industry; whereas, Western's efficiency measure to manage operation and maintenance costs associated with Federal power assets and infrastructure is benchmarked annually against public power entities in the utility industry.

The performance targets and associated performance reporting by the PMAs are synchronized to allow benchmarking of performance and costs as we look for efficiencies in operating, maintaining, and enhancing the Federal grid.

Western's program is subject to continuing independent review by external entities to include Congress (Congressional Research Service), the Government Accountability Office, the Department's Office of Inspector General, Federal Energy Regulatory Commission (FERC), the U.S. Environmental Protection Agency, Office of Personnel Management, NERC and regional reliability councils.

To ensure the continuous operation and reliability of the power system, Western partners with the Department's Office of Cyber Security and Special Reviews and the other power marketing administrations (PMAs) to recertify and accredit mission-critical SCADA systems under the U.S. Department of Commerce's National Institute of Standards and Technology to ensure energy security.

Other

Western's performance targets are extremely ambitious in light of the increasingly fast-paced and complex nature and environment within the electric utility industry, as coupled with the challenges associated with operating, maintaining and expanding the grid to meet future needs. However, Western will ensure it is positioned to effectively address industry trends and issues—be they regulatory, budgetary, legislative, environmental or any other initiatives "not yet conceived"; and will continue to market and deliver Federal power to our customers and contribute to enhancing America's energy security.

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: Western Area Power Administration

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
System Reliability Performance Measure: Meet North American Electric Reliability Corporation (NERC) Control Performance Standards (CPS) of CPS1>100 and CPS2>90 and meet or exceed industry averages. CPS1 measures a generating system's performance at matching supply to changing demand requirements and supporting desired system frequency in one minute increments. CPS2 measures a generating system's performance at limiting the magnitude of generation and demand imbalances in ten minute increments.									
T: CPS1>100, CPS2>90 A: CPS1 184.4, CPS2 98.7	T: CPS1>100, CPS2>90 A: CPS1 181 1, CPS2 98.6	T· CPS1>100, CPS2>90 A: CPS1 187.3, CPS2 99.2	T: CPS1>100, CPS2>90 A: CPS1 188.5, CPS2 99.45	T: CPS1>100, CPS2>90 A:	T: CPS1>100, CPS2>90 A:	T: CPS1>100, CPS2>90 A:	T: CPS1>100, CPS2>90 A:	T: CPS1>100, CPS2>90 A:	T: CPS1>100, CPS2>90 A:
System Reliability Performance Measure: Effectively operate the transmission system to limit the number of accountable outages to no more than 26 annually.									
	T: <=26 A: 18	T: <=26 A: 22	T: <=26 A: 15	T: <=26 A:	T: <=26 A:	T: <=26 A:	T: <=26 A:	T: <=26 A:	T: <=26 A:
Repayment of Investment Performance Measure: Ensure timely repayment of Federal investment in accordance with DOE Order RA 6120.2 by maintaining unpaid investment (UI) equal to or less than the allowable unpaid investment (AUI) **(Definition Revised in 2010).**									
	T: UI/AUI<=1 A: UI/AUI<=1	T. UI/AUI<=1 A: UI/AUI<=1	T. UI/AUI<=1 A. UI/AUI<=1	T: UI/AUI<=1 A:	T: UI<=$8,850 million A:	T: UI<=$8,879 million A:	T: UI<=$8,656 million A:	T: UI<=$8,515 million A:	T: UI<=$8,325 million A:
Efficiency Performance Measure: Provide power at the lowest possible cost by keeping total operation and maintenance expense per kilowatt-hour generated below the national median for public power.*									
				T:<$0.062/kWh A:	T:<$0.062/kWh A:	T:<$0.062/kWh A:	T:<$0.062/kWh A:	T:<$0.062/kWh A:	T.<$0.062/kWh A:

*Performance Measure was added in FY 2010. Future year targets will be adjusted based on the actual national median for public power.

Construction, Rehabilitation, Operation and Maintenance
Western Area Power Administration

Funding by Site by Program

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Western Area Power Administration	901,634	899,317	912,890
Total, Construction, Rehabilitation, Operation and Maintenance	901,634	899,317	912,890

Site Description

Western's service area covers 1.3-million square-miles in 15 States. Western markets and delivers energy to about 665 wholesale power customers. These customers, in turn, provide retail electric service to millions of consumers in these central and western States: Arizona, California, Colorado, Iowa, Kansas, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Texas, Utah and Wyoming.

Western annually markets and transmits about 10,000 megawatts of power from 56 hydropower plants and sells about 40 percent of regional hydroelectric generation. Western also markets the United States' entitlement from the coal-fired Navajo Generating Station near Page, Arizona.

Western operates and maintains an extensive and complex high-voltage transmission system to deliver power to its customers. Using its 17,107-circuit-mile Federal transmission system, Western will market and deliver reliable electric power to most of the western half of the United States.

The power facilities are made up of 14 multipurpose water resource projects and one transmission project. The systems include Western's transmission facilities and power generation facilities owned and operated primarily by the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers and the U.S. Section of the International Boundary and Water Commission.

Power sales, transmission operations and engineering services for Western's system are accomplished by its employees at 51 duty stations located throughout its service area. These include the Corporate Services Office in Lakewood, Colorado, and four customer service regional offices in Billings, Montana; Loveland, Colorado; Phoenix, Arizona; and Folsom, California. The Colorado River Storage Project Management Center in Salt Lake City, Utah, also provides customer support.

Falcon and Amistad Operating and Maintenance Fund
Western Area Power Administration

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Western Area Power Administration	2,959	2,568	3,715
Total, Falcon and Amistad Operating and Maintenance Fund	2,959	2,568	3,715

Site Description

The Falcon-Amistad Project consists of two international dams located on the Rio Grande River between Texas and Mexico. The United States and Mexico operate separate powerplants on each side of the Rio Grande River. The power output is divided evenly between the two Nations. The Department of State's International Boundary and Water Commission (IBWC) owns and operates the U.S. portion of the projects.

Falcon Dam is located about 130 miles upstream from Brownsville, Texas. The United States' portion of construction, operation and maintenance was authorized by Congress in 1950. Construction was started in that year and completed in 1954. The United States' share of Falcon Powerplant capacity is 31.5 megawatts (MW). The powerplant came on line in 1954.

Amistad Dam is located about 300 miles upstream from Falcon Dam. The Amistad Powerplant was constructed by the U.S. Army Corps of Engineers, as agent for the IBWC. The United States' portion of construction, operation and maintenance was authorized by the Mexican-American Treaty Act of 1950. Amistad Dam was completed in 1969. The United States' share of the two generating units, which came on line in 1983, is 66.0 MW.

Project power is marketed to a cooperative in south Texas via Central Power and Light Company's transmission system. There is no Federal transmission associated with these two projects.

Colorado River Basins Power Marketing Fund
Western Area Power Administration

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Western Area Power Administration	240,284	261,723	227,303
Total, Colorado River Basins Power Marketing Fund	240,284	261,723	227,303

Site Description

The Colorado River Basins Power Marketing Program is comprised of three power systems: the Colorado River Storage Project, including the Dolores and Seedskadee Projects; the Fort Peck Project; and the Colorado River Basin Project. Western Area Power Administration is responsible for construction, maintenance, and operation of facilities for transmitting and marketing the electrical energy generated in these power systems. A brief description of each follows:

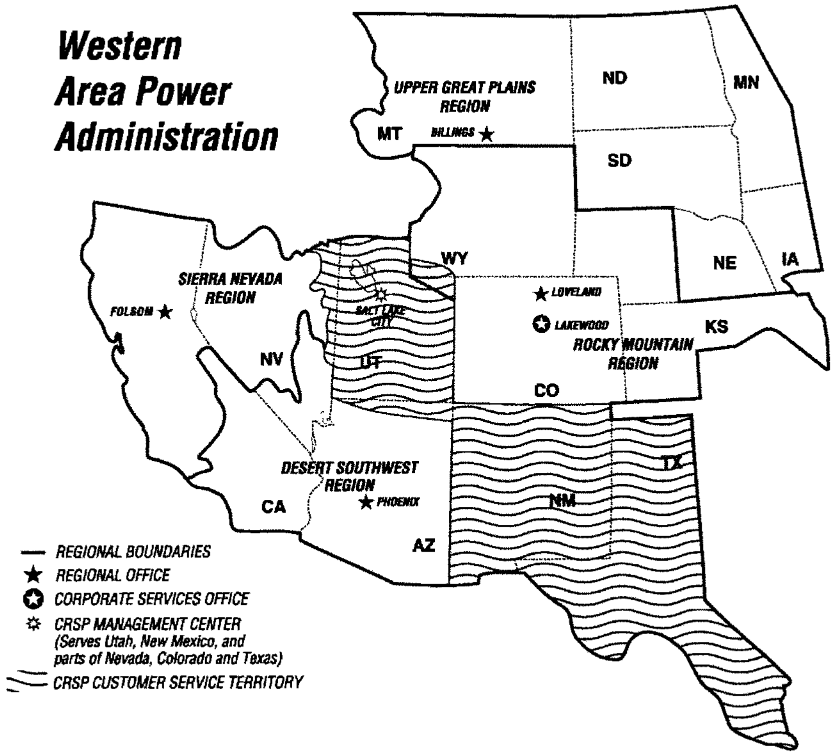
The **Colorado River Storage Project** (CRSP) was authorized in 1956. It consists of four major storage units: Glen Canyon, on the Colorado River in Arizona near the Utah border; Flaming Gorge on the Green River in Utah near the Wyoming border; Navajo on the San Juan River in northwestern New Mexico; and the Wayne N. Aspinall unit on the Gunnison River in west-central Colorado.

CRSP has a combined storage capacity that exceeds 33.5 million acre-feet. Five Federal powerplants associated with the project, with 16 generating units, have an operating capacity of 1,710 MW. CRSP provides for the electrical needs of more than a million people spread across Colorado, Utah, New Mexico and Arizona. Portions of Nevada and Wyoming are also served by CRSP power.

The **Dolores Project**, located in Montezuma and Dolores counties in southwestern Colorado, and the **Seedskadee Project**, located in southwestern Wyoming, were authorized as participating projects of CRSP. Dolores, a multipurpose project, provides 12.8 MW of installed power generating capacity along with municipal and industrial water, irrigation water, and recreation and fish and wildlife enhancement. The Dolores Project powerplants at McPhee Dam and the Towaoc Canal produce 1.3 and 11.5 MW, respectively. Seedskadee's power facilities, associated with the project's Fontenelle Dam, include an 11.5-MW powerplant, switchyard and necessary transmission lines to interconnect with the CRSP transmission system at Flaming Gorge Powerplant.

The **Fort Peck Project**, located on the Missouri River in northeastern Montana, was begun under an Executive Order in October 1933 as part of the Public Works Administration. The Fort Peck Project Act of 1938 authorized the completion, maintenance and operation of the project, and the Flood Control Act of 1944 authorized operational integration of the project with the Pick-Sloan Missouri Basin Program to serve a common market area. Installed generating capacity of the 5 units is 218 MW, which is delivered primarily to customers in eastern Montana and western North Dakota.

The Central Arizona Project (CAP) was authorized as an element of the **Colorado River Basin Project** to furnish irrigation and municipal water supplies to Arizona and New Mexico, and for other purposes. For financing, Western uses reimbursable arrangements to provide for its CAP expenses in lieu of revolving fund authorities.


Western
Area Power
Administration
UPPER GREAT PLAINS REGION
MT
BILLINGS
ND
MN
SD
WY
NE
IA
SIERRA NEVADA REGION
FOLSOM
SALT LAKE CITY
NV
UT
LOVELAND
LAKEWOOD
KS
ROCKY MOUNTAIN REGION
CO
DESERT SOUTHWEST REGION
PHOENIX
CA
AZ
NM
TX
REGIONAL BOUNDARIES
REGIONAL OFFICE
CORPORATE SERVICES OFFICE
CRSP MANAGEMENT CENTER (Serves Utah, New Mexico, and parts of Nevada, Colorado and Texas)
CRSP CUSTOMER SERVICE TERRITORY

Construction, Rehabilitation, Operation and Maintenance
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Construction, Rehabilitation, Operation and Maintenance (CROM)				
Operation and Maintenance (O&M) [a]	52,365	0	57,159	57,793
Construction and Rehabilitation [b]	74,544	0	104,971	109,887
Purchase Power and Wheeling (PPW) [c]	600,960	0	548,847	543,622
Program Direction [d]	166,423	10,000	180,756	193,961
Utah Mitigation and Conservation	7,342	0	7,584	7,627
Total, CROM (Operating Expenses)	901,634	10,000	899,317	912,890
Use of Alternative Financing	-276,804	0	-288,920	-271,895
Offsetting Collections–Colorado River Dam Fund (P.L. 98-381)	-3,366	0	-3,879	-4,212
Offsetting Collections, annual Operation and Maintenance and Program Direction expenses	0	0	-147,530	-180,306
Offsetting Collections–PPW (P.L. 108-447, P.L. 109-103)	-403,118	0	-349,807	-350,919
Total, CROM (Budget Authority)	218,346	10,000	109,181	105,558
Reclassification of Mandatory Receipts to Discretionary Offsetting Collections	0	0	+147,530	0

Public Law Authorizations:
Public Law 57-161, "The Reclamation Act of 1902"
Public Law 78-534, "Flood Control Act of 1944"
Public Law 95-91, "Department of Energy Organization Act" (1977)
Public Law 102-486, "Energy Policy Act of 1992"
Public Law 66-389, "Sundry Civil Appropriations Act" (1922)
Public Law 76-260, "Reclamation Project Act of 1939"
Public Law 80-790, "Emergency Fund Act of 1948"

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[a] O&M funding amounts include activities of the Boulder Canyon Project which are funded through Colorado River Dam Fund receipts via a reimbursable agreement with the Department of Interior as authorized in P.L. 98-381. By year, the amounts are $803,000, $867,000 and $962,000 for FY 2009, FY2010, and FY 2011, respectively. Funding also includes use of alternative financing methods in the amount of $15,499,000, $400,000, and $3,623,000 for FY 2009, FY 2010, and FY 2011, respectively.

[b] Construction and Rehabilitation funding includes use of alternative financing methods in the amount of $47,663,000, $83,760,000, and $72,843,000 for FY 2009, FY 2010, and FY 2011, respectively.

[c] PPW program includes use of receipts from the recovery of PPW expenses of $403,118,000, $349,807,000, and $350,919,000 in FY 2009, FY 2010, and FY 2011, respectively. In addition, alternative financing methods are included in the amounts of $197,842,000, $199,040,000, and $192,703,000 for FY 2009, FY 2010, and FY 2011, respectively.

[d] Program Direction funding amounts include activities of the Boulder Canyon Project funded through the Colorado River Dam Fund via a reimbursable agreement in the amounts of $2,563,000, $3,012,000, and $3,250,000 for FY 2009, FY 2010, and FY 2011, respectively. Funding also includes use of alternative financing methods in the amount of $15,800,000, $5,720,000, and $2,726,000 for FY 2009, FY 2010, and FY 2011, respectively.

Public Law Authorizations:
Public Law 102-575, "Reclamation Projects Authorization and Adjustment Act of 1992"
"Economy Act" of 1932, as amended (41 stat. 613)
"Interior Department Appropriation Act of 1928" (44 stat. 957)
Public Law 70-642, "Boulder Canyon Project Act" (1928)
Public Law 75-756, "Boulder Canyon Project Adjustment Act" (1940)
Public Law 98-381, "Hoover Power Plant Act of 1984"

Mission

Western markets and delivers reliable, cost-based Federal hydroelectric power and related services.

Benefits

Western delivers reliable power and related services across a 1.3-million-square-mile area to a diverse group of about 665 customers, including municipalities, cooperatives, public utility and irrigation districts, Federal and State agencies, and Native American tribes. Western's marketing efforts and delivery capability provide for recovery of annual operational costs, including the generating agencies' hydropower related costs, and repayment of taxpayer investment in the Federal hydropower program. Western repays the Federal investment for which it is responsible within the timeframes established by law and regulations.

Operation and Maintenance
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Operation and Maintenance [a]			
Regular Operation and Maintenance	29,166	38,305	32,232
Replacements and Additions	23,199	18,854	25,561
Total, Operation and Maintenance	52,365	57,159	57,793
Alternative Financing	-15,499	-400	-3,623
Use of Receipts from Colorado River Dam Fund	-803	-867	-962
Offsetting Collections, Annual Expenses	0	-37,038	-31,270
Total, O&M Budget Authority	36,063	18,854	21,938

Description

The mission of Western's Operation and Maintenance (O&M) subprogram is to assure continued reliability of the Federal power system by operating and maintaining Western's transmission system at or above industry standards, including replacement of aging equipment and removal of constraints which would impede power flows.

Benefits

Western's O&M subprogram supports Secretary's Energy Goal to build a competitive, low-carbon economy and secure America's energy future, by emphasizing replacement and upgrading of existing electrical system infrastructure to sustain reliable power delivery to our customers, to support a stable and reliable interconnected power system, to contain annual maintenance expenses, and to retain the value of our assets. Western ensures reliable electric power in a safe, cost-effective manner, and achieves continuity of service throughout its 15-State service territory by maintaining its power system at or above industry maintenance standards, rapidly restoring service following any system disturbance, mitigating adverse environmental impacts, performing clean-up activities, and maximizing revenues gained from non-firm energy and transmission sales.

Detailed Justification

Supplies and materials, such as wood poles, instrument transformers, meters and relays must be procured to provide the necessary resources to respond to routine and emergency situations in Western's high-voltage interconnected transmission system. Western implemented reliability-centered maintenance (RCM) scheduling to contain costs. RCM focuses on identifying critical components in a system and uses preventive and predictive maintenance practices to repair or replace equipment as needed. Technical services, such as waste management disposal, environmental impact analyses, and pest and weed control are used as needed.

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[a] Program descriptions and funding amounts include activities of the Boulder Canyon Project. These activities are funded through receipts from the Colorado River Dam Fund via a reimbursable agreement with the Department of Interior as authorized in P.L. 98-381.

Western's planned replacements and additions activity is based on an assessment of condition and criticality of equipment, maintenance/frequency of problems for individual items of equipment, availability of replacement parts, safety of the public and Western's personnel, environmental concerns, and an orderly work plan. The work plans, coordinated with Western's power customers, who ultimately bear the burden of all Western expenses, reflect an overall sustainable level of effort, with shifts in emphasis between categories (i.e., electrical versus communication equipment) in any given year.

Electrical equipment replacements, such as circuit breakers, transformers, insulators, revenue meters, switches, control boards, relays and oscillographs must be made to assure reliable service to Western's customers. System component age, availability of spare parts, environmental concerns, and risk to system reliability necessitate orderly replacement before significant problems develop.

Replacement, upgrade and installation of fiber optics, Supervisory Control and Data Acquisition (SCADA) systems, and other communication and control equipment continues to provide increased system reliability and to reduce maintenance and equipment costs.

Capitalized movable equipment, such as special purpose vehicles (e.g., cranes, auger trucks, manlifts), special purpose equipment (e.g., pole trailers, industrial tractors, brush chippers), specialized test equipment (e.g., motion analyzers and relay test equipment), computer-aided engineering equipment, office equipment, and IT equipment and software, must be upgraded and replaced.

Personnel expenses and personnel performance accomplishments associated with the O&M subprogram are combined with those of the Construction and Rehabilitation subprogram and are reflected in the Program Direction subprogram of Western's budget request.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Regular Operation and Maintenance	**29,166**	**38,305**	**32,232**

Supplies and materials necessary to respond to routine and emergency situations in Western's high-voltage interconnected transmission system will be purchased. This includes miscellaneous equipment and software used for power billing, transmission planning, e-tagging, and energy scheduling, as well as supplies and materials such as wood poles (individual pole replacement; excludes whole line replacements), instrument transformers, meters, relays, etc. necessary to respond to routine and emergency situations in Western's high-voltage interconnected transmission system. The request includes $962 thousand for activities in the Boulder Canyon Project, funded directly through receipts from the Colorado River Dam Fund.

The continuing maintenance of Western's transmission system at or above industry standards supports DOE's Energy Goal by minimizing sudden failure, unplanned outages, and possible regional power system disruptions. Safe working procedures are discussed before work begins to optimize safety for the public, Western's staff, and equipment. The request is based on projected work plans for activities funded from this account. Estimates are based on historical data of actual supplies needed to operate and maintain the transmission system and recent procurement of similar items.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Replacements and Additions	**23,199**	**18,854**	**25,561**

Western's planned replacements and additions activity is based on an assessment of condition and criticality of equipment, maintenance/frequency of problems on individual items of equipment, availability of replacement parts, safety of the public and Western's personnel, environmental concerns, and an orderly work plan. Replacement of aged power system components maximizes the reliability and availability of Western's system by reducing the risk of equipment failure, unplanned outages, and possible regional power system disruptions. Removing environmental hazards and replacement of aged equipment eliminates safety hazards for the public and Western's personnel. Planned activity is detailed by category below.

▪ **Electrical Equipment**	**9,334**	**7,801**	**12,358**

Electrical equipment, such as circuit breakers, transformers, relays, batteries and chargers, reactors, meters, buses, surge arresters, capacitor banks and disconnect switches, will replace obsolete equipment at facilities throughout Western's 15-State area. Also included is test equipment used by maintenance crews, such as metering and relaying test sets, pentameters, Ohm testers, oil dielectric testers, battery load testers, and specialized communication and environmental control test equipment. Replacement and rehabilitation of single wood pole structures, overhead ground wires, and line hardware will extend the life of aging, deteriorating transmission lines. Examples of specific requests include the Jamestown to Grand Forks 230-kV wood pole rebuild, Edgeley to Forman line upgrade, Dos Amigos breaker replacements, Flanagan substation control system replacement, disconnect switch replacements at Folsom, Lusk transformer replacement and breaker installation, and San Luis pump plant protective relays replacement. Estimates are based on analysis of system operation/maintenance requirements and concerns, customer-coordinated work plans, actual costs of recent similar projects, and bottom-up budgeting techniques.

▪ **Communications Equipment**	**3,943**	**2,783**	**3,882**

Key to system reliability, replacement of remote terminal units, telephone systems, microwave links, and aged 7 Ghz analog radio systems with digital radio and fiber optics continues. Manufacturers have discontinued support of the obsolete analog equipment and there is inadequate channel capacity to support our needs. The staged movement to narrow communications band spectrums for UHF radios as directed by the National Telecommunications and Information Administration (NTIA) continues. Western's communication systems are currently made up of approximately 7 percent fiber optics, 81 percent fixed radio, and 12 percent mobile radio. Western currently has 1,380 radio frequency authorizations for fixed radio bands, of which 469, or 34 percent, are analog. This funding will not be used to replace equipment impacted by the Spectrum Relocation initiative.

In addition, Western will continue to upgrade its existing SCADA systems which control Western's electric power system. These hardware and software upgrades improve grid reliability by allowing the main computer to communicate with remote terminal units in over 300 substations across Western's territory, thus allowing the dispatcher to operate a device in any of these substations to make changes rapidly to respond to power industry requirements or system emergencies. Other specific examples requested in this estimate include the replacement of ground wire on the Beaver

Creek-Sterling transmission line and the Roseville-Elverta line with optical ground wire; SCADA hardware and software for Western's Operations Consolidation Project; replacement of phone lines with VoIP technology; replacement of communication generators; and, installation of fiber multiplex equipment.

Costs are based on analysis of system operation/maintenance requirements, customer-coordinated work plans, actual costs of recent similar projects, and bottom-up budgeting techniques.

	FY 2009	FY 2010	FY 2011
▪ **Spectrum Relocation Equipment**	**0**	**0**	**0**

In December 2004, the Congress passed and the President signed the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494), creating the Spectrum Relocation Fund (SRF) to streamline the relocation of Federal systems from certain spectrum bands to accommodate commercial use by facilitating reimbursement to affected agencies of relocation costs. The Federal Communications Commission has allocated this spectrum for Advanced Wireless Services. Funds have been made available to agencies from the crediting of auction receipts to the SRF during fiscal year 2007 and system relocation efforts have commenced. The amount received by Western for this effort is $108,202 thousand and includes Western's estimated relocation costs, as approved by the Office of Management and Budget, and as reported to the Congress by the Department of Commerce in December 2005. Since receipt of these funds, Western has completed the preliminary and final design work to include radio path analysis, tower load analysis, communication building upgrades and replacements, acquiring radio frequency authorizations, and completing a majority of the radio and other communication equipment purchases. Structural loading analyses for both radio and fiber optic systems were completed in FY 2009. The first construction year for the Spectrum Relocation Fund was during FY 2008 with the beginning of building replacement installations. Continued building replacements, antenna and waveguide installations, and installation of radios will occur in FY2010. The phased replacement of 2 GHz radio systems is anticipated to continue into FY 2011. System clean-up, which includes removal of old equipment, buildings, and all associated systems, is anticipated to continue in FY 2012 and 2013, with project closing activity in FY2014. The funding for the Spectrum Fund is mandatory and will remain available until expended, and agencies will return to the SRF any amounts received in excess of actual relocation costs. No appropriations are being requested for this activity.

	FY 2009	FY 2010	FY 2011
▪ **Capitalized Movable Equipment**	**9,922**	**8,270**	**9,321**

These funds will purchase special purpose line trucks and specialized trailers. Western's first choice of vehicle coverage is a GSA lease, when such vehicles are available. However, GSA cannot always accommodate our needs, especially in the Upper Great Plains Region and somewhat in the Desert Southwest Region, where vehicles must be equipped for extreme weather conditions that exist. At those times, it is necessary to purchase such vehicles, and this request is representative of that condition. All sedans, vans, SUVs, and light trucks are GSA-leased. Western uses 733 vehicles, 429 (59 percent) of which are leased from GSA. Replacement of government-owned vehicles is based on the Federal Management Regulations guidelines, the same guidelines used by GSA. Examples of specialized equipment such as pole trailers, road graders, digger trucks, man

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

lifts, snow cats, snow tractors, forklifts, cranes, front-end loaders, and caterpillars are included in this request.

Other capitalized movable equipment in this estimate that are needed to support the O&M of the interconnected power system include substation test equipment, brush chipper, map board replacement; security equipment such as perimeter intrusion detection devices, card readers and associated software, security cameras and recording devices at various sites throughout Western; Information Technology equipment such as server and router replacements, firewalls, cyber security upgrades, LAN upgrades, network equipment replacements, business tape backup library, disaster recovery and backup/restore equipment, replacement of equipment for the MiniPower Simulator at Western's Electric Power Training Center to accommodate changes in technology; and helicopter equipment replacements that add value to the helicopter or extend the service life, such as engine, rotor blades, avionics, airframe, and other major components.

Replacement needs are based on age, reliability, and safety of equipment, customer-coordinated review, cost analysis of rebuild versus replacement, availability of replacement parts, and obsolescence of diagnostic maintenance tools. Estimates are determined using actual costs of similar items.

	FY 2009	FY 2010	FY 2011
Total, Operation and Maintenance	**52,365**	**57,159**	**57,793**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Regular Operation and Maintenance	
▪ The overall net decrease in regular O&M is attributed to the cyclical decrease in maintenance activities with the offset increase to Replacements and Additions.	-6,073
Replacements and Additions	
▪ The increase in replacements and additions of electrical equipment (+$4.6 million) is primarily attributable to the increased requirements for line upgrades and rebuilds of Western's aging infrastructure. Increased requirements also include aged and failing transformer replacement and protective equipment to aid in voltage control. The increase in communications equipment (+$1.1 million) is requested to replace segments of Western's ground wire due to faulty ground wire with optical ground wire. Funds are also requested to convert segments of Western's communication equipment from analog to digital. The increase in capitalized movable equipment (+1.0 million) is attributable to an increase in special vehicle purchases, cyber security equipment, maintenance test equipment required due to new innovations in power system equipment, and IT hardware.	+6,707
Total Funding Change, Operation and Maintenance	**+634**

Construction and Rehabilitation
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Construction and Rehabilitation			
Transmission Lines and Terminal Facilities	26,176	43,224	60,656
Substations	40,522	43,157	46,275
Other [a]	7,846	18,590	2,956
Subtotal, Construction & Rehabilitation	74,544	104,971	109,887
Alternative Financing [b]	-47,663	-83,760	-72,843
Total, Construction & Rehabilitation (Budget Authority)	26,881	21,211	37,044

Description

The mission of Western's Construction and Rehabilitation (C&R) subprogram is to assure continued reliability of the Federal power system by modification, replacement, additions, and interconnections to the Federal power system.

Benefits

Western's C&R subprogram supports the Secretary's Energy Goal to build a competitive, low-carbon economy and secure America's energy future by emphasizing replacement and upgrading of existing electrical system infrastructure to sustain reliable power delivery to our customers, to support a stable and reliable interconnected power system, to contain annual maintenance expenses, and to retain the value of its assets. Replacement and upgrade of aged power system components are crucial to system reliability, and communications improvements maintain vital control over system operations. Both contribute to attaining or exceeding monthly control performance standards established by the North American Electric Reliability Corporation (NERC) by reducing the risk of equipment failure, unplanned outages, and possible local and regional power system disruptions. C&R subprogram activities support the repayment of Federal power investment by promoting a well-planned C&R program with a relatively stable budget over the long term, by avoiding significant additional costs of emergency "breakdown maintenance," and by preventing outages which could impact power deliveries, purchase power costs, and power revenues. Reducing the hazards associated with worn or aging equipment, correcting design deficiencies, and replacing deteriorated wood poles which present a serious climbing hazard to linemen, minimizes Western's exposure to unsafe conditions. In addition, public safety is protected by avoiding or minimizing the negative impacts of unplanned outages and by minimizing the instances of downed transmission lines.

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[a] Other includes communication equipment, maintenance facilities, power facility developmental costs, and minor unscheduled jobs.

[b] Alternative financing for Construction and Rehabilitation is dependent on cash advances from customers.

Detailed Justification

(dollars in thousands)

The C&R request incorporates the most current information to identify and schedule necessary C&R projects. Western assigns the highest program priority to those situations that pose the highest risk to safety and system reliability, while meeting the mandates for open access to our transmission system. If conditions change, Western will shift funding as necessary to ensure the highest program priorities continue to be met to maintain the reliability and integrity of Western's power transmission system.

Western's transmission system has 17,107 circuit-miles of line and more than 300 substations. Of the 8,038 miles of wood poles, 5,917, or 74 percent, exceed the normal service life of 40 years, with 4,708, or 59 percent, exceeding 50 years. Western is continually testing, treating, and replacing individual wood poles and hardware to delay the need for replacing an entire transmission line. As substation equipment (such as power transformers, circuit breakers, and control equipment) ages, maintenance costs increase, replacement parts become unavailable, risk of outages increase, and system reliability declines. The normal service life for power transformers and power circuit breakers is 40 years and 35 years, respectively. While replacement of this equipment is systematically planned over 10 years, actual replacement varies depending on condition and criticality. All replacement and rehabilitation plans are coordinated with customers to help establish the timing and scope of work at specific substations. When upgrades or additional capacity are required, Western actively pursues opportunities to partner with neighboring utilities to jointly finance activities, which result in realized cost savings and increased efficiencies for all participants.

Western's FY 2011 C&R request is above prior year levels because of the aging power system infrastructure, backlog of rehabilitation needs, increasing industry requirements (FERC, NERC, WECC), and greater reliability concerns resulting from increasing loads and the need for integrating new generation sources to meet those loads.

Financing of the FY 2011 C&R budget will continue to rely heavily on customer participation in alternative financing methods. Approximately 66% of the program, or $72.8 million, will be requested from customers.

Personnel costs and related expenses for the workforce to plan, collect field data, write specifications, design facilities, award construction contracts, and purchase government-furnished equipment for the C&R activity are combined with those of the O&M activity and are reflected in the Program Direction section of Western's budget request.

Costs incurred within the C&R program are generally capitalized and recovered with interest over the useful life of the asset. In rare cases where a C&R project is abandoned, associated costs are expended.

For purposes of budget display, the C&R subprogram is broken into three activities: Transmission Lines and Terminal Facilities, Substations, and Other. The Other category includes communications equipment (microwave, fiber optic, and telecommunications), maintenance facilities, power facility development costs, and minor unscheduled jobs. Planned activity is detailed by category below.

	FY 2009	FY 2010	FY 2011
Transmission Lines and Terminal Facilities	**26,176**	**43,224**	**60,656**
▪ **Transmission Lines and Terminal Facilities, Continuing Work**	**17,826**	**24,957**	**39,233**

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

Continuation of modifications and rehabilitation of the following transmission lines (TL) to ensure power system reliability and stability is planned in FY 2011. Net appropriations requested are $8,583,000. At this level, the following activities are planned:

- Davis-MEC Kingman Tap - Rebuild existing 27.3-mile Davis Switchyard to MEC Kingman Tap transmission line (Arizona). The 60 year old line is well beyond its engineered life span and is showing significant deterioration. The condition of the line, operated radially from Davis Substation, is a reliability concern for several utilities; it's also a safety concern for maintenance crews and residential and commercial areas encroaching on the existing right-of-ways.
- Upgrade the 500-kV California-Oregon Intertie (COI) to increase transfer capabilities across the California-Oregon border. The upgrade will increase the north-to-south COI rating by 300 MW, from 4800 MW to 5100 MW, allowing for greater import of energy, either renewable or non-renewable, from the Pacific-Northwest into California.
- Renew the transmission line right-of-way between Rogers and Coolidge Substations (Arizona). Agreement between Western and the Gila River Indian Community provides for the addition of a 230/69 kV transformer in the Coolidge Substation to serve the Gila River Indian Community.

Alternative financing will be pursued to fund the remaining on-going transmission line rehabilitation efforts estimated at $30,650,000 in FY 2011. Funding for these projects are at risk however since alternative financing is voluntary on the part of customers. The ongoing activities are:

- O'Banion-Elverta – Continue joint construction of the new 31-mile O'Banion to Elverta double circuit 230-kV line (California) consistent with the Sacramento Voltage Support Environmental Impact Statement. The project will relieve constrained generation, improving area voltage support and increasing stability and reliability for the greater Sacramento area.
- Lovell-Yellowtail – Rebuild the 46 mile Lovell-Yellowtail No. 1 and No. 2 transmission lines (Wyoming). The rebuild will include transmission lines within the National Park Service boundary of the Big Horn National Recreation Area, and involve reclamation of redundant and non-critical access roads within the park. The rebuild of the 55- and 45-year old lines, respectively, are needed to improve reliability and system capability in the northern Wyoming service area. Inspections show an increasing percentage of deteriorating structures; nearly one out of every three was rejected.

	FY 2009	FY 2010	FY 2011
▪ **Transmission Lines and Terminal Facilities, Rehabilitation Starts**	**8,350**	**18,267**	**21,423**

The following transmission line and terminal facility rehabilitation starts are planned in FY 2011. Transmission line and terminal facility starts address specific system reliability risks or operational problems. The FY 2011 request includes $7,825,000 appropriations to:

- Rebuild the 19.1 mile Oracle-Saguaro 115-kV transmission facilities, built in the late 1950s. The line passes through a variety of terrain in western Arizona, including desert, cultivated

	(dollars in thousands) FY 2009	FY 2010	FY 2011

fields, hilly terrain, and residential. The bulk of the wood structures are well beyond their engineered lifespan and are showing signs of deterioration; including advanced external shell rot, weathering, and large cracks. The transmission line is a critical component of Western's system. The rebuild is necessary to maintain reliability and safety.

Alternative financing will be pursued to fund the remaining new transmission line rehabilitation efforts estimated at $13,598,000 in FY 2011. Funding for these projects are at risk however since alternative financing is voluntary on the part of customers. These activities are:

- Rebuild the 52-mile, 161-kV Blythe-Headgate Rock transmission line (Arizona). The 60-year-old line is well beyond its engineered lifespan, and is exhibiting deterioration, including shell rot, weathering, and cracking. The condition of the line is a significant reliability and safety concern. A significant portion of the line is located on Colorado River Indian Tribe lands, including several structures on tribal historic site called Black Point Mesa.
- Rebuild the 45-mile, 115-kV Coolidge-Oracle transmission line (Arizona). The 65-year-old line is also deteriorating. Shell rot, excessive weathering and cracking are a serious reliability concern to Western's 115-kV system and a safety concern for the maintenance personnel. Other issues affecting the line are raked and bowed poles, vehicle strikes, lightning and fire damage, water damage, flashover indications, broken and/or damaged insulators, and loose/missing hardware. Access constraints to these remote desert areas make addressing these problems through increased maintenance efforts lengthy and costly.
- Cottonwood-Roseville – Initiate reconductoring of the existing 140-mile 230-kV transmission line from Cottonwood to Roseville (California). The existing line is experiencing frequent outages as a result of the growing demand on the line. Replacement with larger conductors, and adding 5 mile double circuit loop through the O'Banion substation will increase capacity on the existing right-of-way by 90 MW, and significantly improve reliability throughout the region.

Estimates are based on actual costs of recent similar projects, expected costs of needed equipment and services, cost estimating guides, and experience.

Substations	**40,522**	**43,157**	**46,275**
▪ **Substations, Continuing Work**	**21,394**	**26,028**	**40,218**

Continue modifications and rehabilitation of the following substations in FY 2011 to ensure power system reliability and stability. The funding level is determined by estimating the cost to complete each project and breaking out these costs by fiscal year. The estimates are based on recent actual costs to complete similar projects, updated individual project requirements, and past experience. The FY 2011 request includes $14,671,000 in appropriations for continuing the following ongoing rehabilitation work at Western substations:

- Rebuild Bouse Tap (Arizona) as a three breaker ring bus to improve system reliability by restoring remote operating and emergency line-break capability to this segment of the Parker-Gila 161-kV transmission line. The existing switchyard, constructed in the early 1950's, has exceeded its useful life and can no longer support remote operations. Customer participation in

(dollars in thousands)

FY 2009	FY 2010	FY 2011

funding is anticipated to cover more than a quarter of the project's costs.

- Rebuild aging Davis Switchyards (Arizona) built in the late 1940s to provide increased reliability. The bulk of the equipment in the yards is operating beyond their useful service lives. Problems include failing circuit breakers, unreliable regulating transformer, broken disconnects, oil leaks, and abandoned equipment. The rebuild will provide a more effective bus arrangement, replace oil-filled circuit breakers with SF6 gas breakers to eliminate over 140,000 gallons of oil from the site adjacent to the Colorado River, and construct a control building to house the relays, control equipment, and battery systems.
- Upgrade of ED5 Tap Substation (Arizona) with a new five circuit breaker ring bus to replace the existing tap. Constructed in 1952, the existing motor-operated disconnects have not been upgraded, are deteriorating, and are a reliability concern. They are not capable of interrupting load or fault current, making maintenance difficult and costly. Spare parts are obsolete and difficult to replace.
- Mead Sub - Replace the 345-kV transformer at Mead Substation south of Boulder City (Nevada) providing the sole feed from Mead Substation to the heavily loaded Mead-Peacock 345-kV transmission line. Testing on this 45-year old transformer indicates both internal and external deterioration, including leaking, bushing and insulation degradation. Replacement will improve reliability of this critical component of the Mead to Peacock system, dramatically reducing the risk of failure and line outage.
- Liberty Sub – Replace the 345-kV transformer at Liberty Substation in western Phoenix (Arizona) supporting the critical 345-kV Liberty to Peacock transmission line. Testing on the 43-year old transformer indicates both internal and external deterioration, including extensive leaking from several areas of the transformer. Replacement is necessary to avoid catastrophic failure and/or lengthy outage on the heavily loaded Liberty-Peacock transmission line
- O'Neill Sub - Rebuild the 40 year old O'Neill Substation (California) to improve the reliability of the electrical supply facilities for the O'Neil pump/generating station. The substation is the sole source of power to six large pump/generation units operated by the U.S. Bureau of Reclamation as part of the San Luis Water Project.

Alternative methods of financing will be pursued to fund the remaining on-going substation rehabilitation efforts estimated at $25,547,000 in FY 2011. Funding for these projects are at risk however since alternative financing is limited and voluntary on the part of customers. Ongoing substation rehabilitation activities relying on customer financing are:

- Replacement of two transformers, KU3A and KU4A, at the Bismark Substation (North Dakota) with 200 MVA units and construction of a dedicated 230-kV bay for KU4A to provide increased reliability required by the addition of another interconnection and significant commercial and residential load growth in the area.
- Joint effort to construct a 230-kV substation (Appeldorn Substation) on the Watertown-Granite Falls 230-kV line near Boyd, Minnesota. Electric loads in the area have grown beyond the capability of Western's delivery points to the customer, affecting Western's reliability of

(dollars in thousands)

FY 2009	FY 2010	FY 2011

service. Western requests funding for the base 230-kV substation and customer will fund the transformer and bus structure requirements.

- Replace the Edgeley Substation (North Dakota) aging 1952 transformer KY1A and add equipment for improved protection, reliability, and operating flexibility.
- Replace the Sioux Falls (South Dakota) transformers KV3A (230/115 33.3 MVA) and KV5A (230/115 33.3 MVA) with 250 MVA 3-phase autotransformers to improve system reliability. System studies identify capacity deficiencies in the existing transformers as a result of significant commercial and residential load growth.
- Addition of a 230/115-kV transformer and power circuit breakers at Weld Substation (Colorado). The underlying 115-kV system is no longer adequate to reliably serve loads in the area. Addition of the transformer will improve system reliability and meet NERC N-1 overload contingency mitigation requirements. This is part of a joint project in combination with transmission line upgrades providing greater voltage support for northern Colorado loads.
- O'Banion - Construct a new 500-kV O'Banion Substation (California) with 500/230-kV transformation. Loop the existing PG&E's Table Mountain – Tesla 500-kV line into the new 500-kV yard. Add breaker bay and associated protection and control circuits to the existing O'Banion 230-kV yard as required. The project will improve the reliability of the CVP transmission system, conform to NERC/WECC reliability criteria, meet Western's transmission service obligations, and inhibit uncontrolled system-wide outages and loss of load impacting on local and regional grid and economies.
- Tracy Sub - Upgrade Tracy 230-kV Substation (California) to a double-breaker, double-bus configuration by adding breakers, disconnects, bus, and associated control, protection and communication equipment. The upgrade is necessary to meet operational reliability requirements for this very critical substation that serves central California and the San Francisco Bay Area. The current substation design is a main and transfer bus configuration which can lead to loss of up to six critical 230-kV transmission lines, two major ties to the Tracy 500-kV Substation, and the entire Tracy pumping plant if breaker failure happens due to human error or failure of breaker protection equipment. This would represent a loss of 2,150 MVA of transfer capacity, potentially causing a major West Coast power outage during critical load times of the year.

	FY 2009	FY 2010	FY 2011
▪ **Substations, Rehabilitation Starts**	**19,128**	**17,129**	**6,057**

Several substation rehabilitation activities are planned to begin in FY 2011. Net appropriations of $4,980,000 are requested to directly fund a portion of these activities. At this level, the following substation rehabilitation activities will be started:

- Replace two aging transformers KY1A and KY1B at the Spencer Substation (Iowa). The replacements will increase the capacity to 100 MVA as the current loading conditions exceed the operating capability the existing 53 and 56-year-old transformers provide.
- Install 15 MVAR 115-kV shunt capacitor bank at both Western's Frenchman Creek Substation (Colorado) and Sidney Substation (Nebraska) to provide permanent voltage support. The

(dollars in thousands)

capacitor banks are necessary to avoid reductions to the transfer capability across the constrained TOT3, and/or establishment of load shedding requirements during peak load conditions.

Alternative methods of financing will be pursued to fund the remaining substation rehabilitation efforts estimated at $1,077,000. Funding to start these rehabilitation efforts are at risk however since alternative financing is limited and voluntary on the part of customers. The projects are dependent on alternative customer financing are:

- Construction of a 115-kV switching station near Elliot, North Dakota, on the Forman-Valley City transmission line. The new interconnection is requested to provide greater reliability and system protection in response to area load growth.
- Addition of a customer furnished 115/69 kV transformer to Western's Rapid City Substation (South Dakota) to provide greater reliability and operating flexibility necessary to meet substantial load growth in the area.

The funding level is determined by estimating the cost to complete each project and breaking out these costs by fiscal year. The estimates are based on recent actual costs to complete similar projects, updated individual project requirements, and past experience.

	FY 2009	FY 2010	FY 2011
Other	**7,846**	**18,590**	**2,956**
▪ **Communications Systems**	**5,386**	**2,982**	**2,036**

Each project cost is determined using the actual costs of recent similar projects, estimated quantities of needed materials, past contract costs, specialized cost estimating guides, and in-house experience. Net appropriations requested are $565,000. At this level, work will continue to proceed on an alternate control center for the Sierra Nevada Region sub-control area.

Alternative customer financing of $1,471,000 will be needed to continue to replace, modernize, and expand communication systems (microwave, fiber optic, global information system, and telecommunication) in the Central Valley Project and the Pick-Sloan Missouri Basin Program to operate and control the transmission system. Replacement parts for existing obsolete communications systems are difficult to obtain and the increased use of remote control of facilities, coupled with the need for greater integration of the Federal system with the rest of the grid and technological advances in the communications field, make secure and reliable communications crucial to Western's mission. Rapid advances in technology and manufacturers' phase-out of support for existing systems drive the need for communications replacements and upgrades. Effective control of remote facilities is crucial to the operation of the power system. The equipment requested here is not included in the Spectrum Relocation Fund initiative.

	FY 2009	FY 2010	FY 2011
▪ **Miscellaneous**	**2,460**	**15,608**	**920**

The FY 2011 request provides $420,000 to:

- Continue Western's power facility development activities providing technical products in support of the year's C&R program activities.
- Demolish the West Fargo maintenance shop/storage building and replace with same size 60' x

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

80' structure at the same location. The existing building is a significant safety concern. Deficiencies include asbestos contaminated material, drainage problems, heaving of exterior perimeter apron leading to water infiltration, extensive corrosion at base and anchor connections, rusting support beams, leaking roof, water penetration in electrical fixtures, and excessive mold.

Alternative methods of financing will be pursued to fund the remaining miscellaneous efforts estimated at $500,000 in FY 2011. Alternative financing is limited and voluntary on the part of customers.

- Continue the demolition and clean-up of the decommissioned Mesa Substation (Arizona) built in the early 1940s.

	FY 2009	FY 2010	FY 2011
Total, Construction and Rehabilitation	**74,544**	**104,971**	**109,887**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Transmission Lines and Terminal Facilities	
▪ The increase in Transmission Lines and Terminal Facilities is due to increases in both new and ongoing transmission line construction project activity. The increase reflects the continued aging of Western's transmission infrastructure and the area load growth in the regions we serve. Thousands of miles of transmission line, built mostly in the 1940s through 60s, exceed their design life. Significant effort is needed to replace the aging infrastructure across Western's service area. For FY 2011 specifically, activities are underway to address deteriorating transmission lines in Arizona, Wyoming, and the Pick-Sloan Missouri Basin service territory, and voltage support problems in the growing Sacramento area.	+17,432
Substations	
▪ The increase is due primarily to several substation rehabilitation efforts ongoing from prior years that will be moving into the build phase. In addition, several more substation rehabilitation efforts will begin in FY 2011 reflecting the aging infrastructure across Western's service territory and the increasing demand on the Federal transmission facilities.	+3,118

	FY 2011 vs. FY 2010 ($000)
Other	
▪ Funding needs for Other capital expenditures, including communications, buildings, roads, and other miscellaneous construction activities is decreasing significantly in FY 2011. The FY 2010 appropriation included $15,248,000 on a nonreimbursable basis for environmental remediation work at the Basic Substation located in Henderson, Nevada.	-15,634
Total Funding Change, Construction and Rehabilitation	**+4,916**

Purchase Power and Wheeling
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Purchase Power and Wheeling			
Central Valley Project	295,472	284,441	293,721
Pick-Sloan Missouri Basin and Other Programs	305,488	264,406	249,901
Subtotal, Purchase Power and Wheeling (Gross)	600,960	548,847	543,622
Use of Alternative Financing [a]	-197,842	-199,040	-192,703
Subtotal, Purchase Power and Wheeling	403,118	349,807	350,919
Offsetting Collections Realized	-403,118	-349,807	-350,919
Total, Purchase Power and Wheeling (Budget Authority)	0	0	0

Description

The mission of the Purchase Power and Wheeling (PPW) subprogram is to support Western's long-term firm power sale contractual agreements, including wheeling over non-Federal transmission lines as necessary to deliver the firm hydropower resource to customers.

Benefits

The PPW subprogram supports Western's mission to market and deliver reliable, cost-based hydroelectric power and related services. These services are marketed at rates sufficient to recover expenses and Federal investment as established by law. To maximize the marketability of Western's products, Western has entered into long-term contracts with customers of the Central Valley Project (CVP), the Pick-Sloan Missouri Basin Program, as well as other projects, to deliver power based on the normal (average over the long-term) amount of power and/or capacity available from each of the power systems. By its nature, hydropower is a variable resource; it is affected by reservoir storage, drought conditions, powerplant maintenance and other project purposes. Variations occur between load and the hydro-generation hour-by-hour or even minute-by-minute. Western buys power and related transmission services to fulfill its firm power-sale contractual commitments. Western also buys transmission services, as needed, to provide the benefits of the Federal hydropower resource to numerous Federal, State, municipal, and other preference customers not directly connected to Western's system. Contracting for transmission services encourages the widespread use principle of the Flood Control Act of 1944 and avoids unnecessary Federal duplication of available transmission resources. The acquisition of non-Federal power and transmission services meets Western's power marketing contract provisions which place responsibilities on Western to provide firm power to customers of the Central Valley Project, Pick-Sloan Missouri Basin Program-Eastern Division, Loveland Area Projects and Parker-Davis Project.

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[a] Alternative financing for purchase power and wheeling anticipates $176,548,000, $177,565,000, and $174,536,000 net billing and/or bill crediting in FY 2009, FY 2010, and FY 2011, respectively. Alternative financing also includes reimbursable customer funding planned at $21,294,000, $21,475,000, and $18,167,000 in FY 2009, FY 2010, and FY 2011, respectively.

The FY 2011 request provides for continuation of PPW receipt funded activities at the estimated level necessary to meet contractual firming needs. No appropriated budget authority is necessary. The request for receipt authority reflects improving water conditions in the drought-stricken Pick-Sloan Missouri River Basin.

The following table illustrates the PPW program assumptions.

Purchase Power and Wheeling Program Assumptions

(dollars in thousands)

	FY 2009 Enacted	FY 2010 Enacted	FY 2011 Request
Power Purchases (gigawatthours)			
Central Valley Project	4,295	4,293	4,475
Pick-Sloan Missouri Basin and Other Programs	4,996	4,290	3,805
Total, Purchases	9,291	8,583	8,280
Purchase Power Prices ($/megawatthour)			
Central Valley Project	55.1	55.4	54.9
Pick-Sloan Missouri Basin and Other Programs	57.4	57.2	60.8
Cost of Power Purchases ($000)			
Central Valley Project	236,601	237,945	245,786
Pick-Sloan Missouri Basin and Other Programs	286,890	245,535	231,497
Total, Purchase Power Costs	523,491	483,480	477,283
Wheeling Costs ($000)			
Central Valley Project	58,871	46,496	47,935
Pick-Sloan Missouri Basin and Other Programs	18,598	18,871	18,404
Total, Wheeling Costs	77,469	65,367	66,339
Total, Purchase Power and Wheeling ($000)	600,960	548,847	543,622

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Central Valley Project	**134,706**	**122,361**	**132,679**

No appropriations are requested. This is authority to use offsetting collections only.

▪ **Central Valley Project, Program Requirement**	**295,472**	**284,441**	**293,721**

In FY 2011, Western continues to deliver on its contractual power commitments to customers under the Central Valley Project's Post 2004 Marketing Plan. The budget request assumes current full

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

load service customers will continue to choose service from Western through "Custom Product" contractual arrangements. Western also purchases power to support variable resource customers on a pass-thru basis. If project net generation is not sufficient, Western may also purchase to support project use load, First Preference Customer load, and sub-control area reserve requirements.

	FY 2009	FY 2010	FY 2011
▪ **Central Valley Project, Alternative/Customer Financing**	**-160,766**	**-162,080**	**-161,042**

Contractual arrangements have been made with customers providing opportunities for alternative financing of the purchase power requirements. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding.

	FY 2009	FY 2010	FY 2011
Pick-Sloan Missouri Basin and Other Programs	**268,412**	**227,446**	**218,240**

No appropriations are requested. This is authority to use offsetting collections only.

	FY 2009	FY 2010	FY 2011
▪ **Pick-Sloan Missouri Basin and Other Programs, Program Requirement**	**305,488**	**264,406**	**249,901**

In FY 2011, the request continues to support long-term firm power commitments to customers of the Eastern and Western divisions of the Pick-Sloan Missouri Basin Program, the Fryingpan-Arkansas Project, and the Parker-Davis Project commensurate with the levels of average firm hydroelectric energy marketed by Western. The request also provides transmission support for the Pacific Northwest-Southwest Intertie Project. The total program estimates shown for FY 2011 are based primarily on market pricing of short-term firm energy, negotiated transmission rates, and Western and generating agency's forecasts. The FY 2011 program forecasts reduced purchases.

	FY 2009	FY 2010	FY 2011
▪ **Pick-Sloan Missouri Basin and Other Programs, Alternative/Customer Financing**	**-37,076**	**-36,960**	**-31,661**

Alternative financing methods negotiated with customers will be used where effective to provide an offset to the total program receipt financing requirement. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding.

	FY 2009	FY 2010	FY 2011
Total, Purchase Power and Wheeling	**403,118**	**349,807**	**350,919**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Central Valley Project ▪ The gross PPW requirement of $293.7 million in FY 2011 increases 3.3% from the $284.4 million level anticipated in FY 2010 providing for slight increase in anticipated purchases to meet marketed requirements. ▪ Note: The PPW amounts are for offsetting collection authority and alternative financing; no direct appropriations are necessary.	+9,280
Pick-Sloan Missouri Basin and Other Programs ▪ The gross PPW requirement of $249.9 million in FY 2011 is down by $14.5 million from the $264.4 million estimated for FY 2010. The decrease reflects a reduction in power purchased in anticipation of improving water conditions in the drought stricken Pick-Sloan Missouri Basin region. ▪ Note: The PPW amounts are for offsetting collection authority and alternative financing; no direct appropriations are requested for this activity.	-14,505
Total Funding Change, Purchase Power and Wheeling	**-5,225**

Program Direction
Funding Profile by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Program Direction [a]			
Salaries & Benefits	114,527	123,197	133,410
Travel	8,382	8,684	9,421
Support Services	24,265	26,552	27,902
Other Related Services	19,249	22,323	23,228
Total, Program	166,423	180,756	193,961
Less Use of Alternative Financing	-15,800	-5,720	-2,726
Use of Receipts from Colorado River Dam Fund	-2,563	-3,012	-3,250
Offsetting Collections, Annual Expenses	0	-110,492	-149,036
Total, Program Direction Budget Authority	148,060	61,532	38,949
Full Time Equivalents	1,073	1,107	1,114

Mission

Western's Program Direction subprogram provides compensation and all related expenses for the workforce that operates and maintains Western's high-voltage interconnected transmission system and associated facilities; those that plan, design, and supervise the construction of replacements, upgrades and additions (capital investments) to the transmission facilities; and those that market the power and energy produced to repay annual expenses and capital investment.

The Program Direction subprogram supports the Secretary's Energy Goal to build a competitive, low carbon economy and secure America's energy future. To attain reliability performance, dispatchers match generation to load minute-by-minute to meet or exceed performance levels established by NERC. Western maintains the interconnected system at or above industry standards to reduce transmission outages. Energy schedulers maximize revenues from non-firm energy sales and power rates are reviewed and adjusted to support repayment of Federal investment. Western trains its employees on a continuing basis in occupational safety and health regulations, policies and procedures, and conducts safety meetings at employee, supervisory and management levels to keep the safety culture strong. Accidents are reviewed to ensure lessons are learned and proper work protocol is in place.

The Program Direction subprogram further supports Western's Human Capital Management (HCM) Workforce Plan. HCM Workforce Plan activities include: exploring ways to increase HR efficiency through consolidation; the development and/or expansion of intern/apprenticeship programs in the occupations of energy marketing, dispatcher, lineman, and electrician; introduction of an under-study program in Power Marketing, prior to an incumbent retiring; rotational training programs for engineers;

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[a] Program descriptions and funding amounts include activities of the Boulder Canyon Project. These activities are funded through a Reimbursable Agreement with the Department of the Interior, Bureau of Reclamation.

strategic use of knowledge sharing and training events in critical occupations; and, succession planning development programs for mid- to upper-level graded Federal positions. Western's 50/5/5 Trainee Program is part of its succession planning which trains employees in critical positions in known areas soon to be vacated by retiring employees. By design, costs for these HCM programs will be minimal as local area expertise and facilities will be used to the maximum extent possible. The HCM Workforce Plan noted that no new A-76 studies were required and/or anticipated at this time.

Western operates and maintains a transmission system to deliver reliable electric power in a clean and environmentally-safe, cost-effective manner within its 15-State service territory. Western achieves continuity of service by maintaining its power system at or above industry standards, rapidly restoring service following any system disturbance, mitigating adverse environmental impacts, performing environmental clean-up activities, and maximizing the benefits gained from non-firm energy sales.

In concert with its customers, Western reviews required replacements and upgrades to its existing infrastructure to sustain reliable power delivery to its customers and to contain annual maintenance expenses. The timing and scope of these replacements and upgrades are critical to assure that Western's facilities do not become the "weak link" in the interconnected system. Western pursues opportunities to join with neighboring utilities to jointly finance activities, which avoid redundant facilities and result in realized cost savings and/or increased efficiencies for all participants.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**114,527**	**123,197**	**133,410**

Salaries and benefits are provided for Federal employees to operate and maintain, on a continuing basis, Western's high-voltage interconnected transmission system comprised of 17,107 circuit-miles of line, 302 substations, associated power system control and communication, and general plant facilities. Craft workers rapidly restore the transmission system following any disturbance, and routinely maintain and/or replace equipment to assure capability for reliable delivery of power. Dispatchers provide 24-hour-a-day operation of four dispatching centers and one reliability coordination center. Dispatchers respond to minute-by-minute changes to load and generation to meet or exceed NERC and industry averages for system reliability and performance. Engineers and craft workers maintain the interconnected system at or above industry standards to reduce transmission outages. Energy schedulers maximize revenues from non-firm energy sales. Staff provides continuing services such as system operations, power billing and collection, power marketing, rate setting, energy services, environmental, safety, security and emergency management. Due to the extreme hazards associated with a high-voltage electrical system, staff makes safety a priority in each and every task. Staff inspects construction activities in progress (identified in the Construction and Rehabilitation activity) to ensure quality results and safe working methods. General power resources planning and preconstruction activities continue, including planning, environmental clearance, collection of field data, design of facilities, and issuance of specifications for future rehabilitation and upgrades of existing transmission lines and the review/coordination of requests for transmission system interconnections. Staff evaluates general power resources, collaborating and planning with customers and other members of the interconnected transmission system, to identify the most effective transmission system improvements to maximize benefits to all participants. Western participates in public meetings with customers and initiatives

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

supported by the Department.

Total FTE numbers for FY 2011 include 1,114 for Western's Construction, Rehabilitation, Operation and Maintenance (CROM) Account activities. Included in this amount are 18 FTE for Boulder Canyon Project (BCP) activities accomplished using receipts from the Colorado River Dam Fund under a reimbursable agreement with the Bureau of Reclamation. FTE reflected for CROM Account activities total 1,073 and 1,107 for FY 2009 and 2010, respectively, which includes the FTE associated with BCP activities of 15 for FY 2009 and 17 for FY 2010. The change of FTE reflected in FY 2011 for Western's CROM Account is attributable to increase of 13 FTE for Western's Operations Consolidation Project, which will enable Western to lessen the future staffing and budget impacts of complying with new regulations by consolidating operations functions, where feasible. This increase is offset by a shift in 6 FTE in support of O&M activities under the Colorado River Basins Power Marketing Fund (CRBPMF).

The FY 2011 program level for salary and benefits reflects the increase in FTE and the anticipated salary to fund the majority of the FTE financed in this account. The program request includes approximately $2,216 thousand for salary and benefit activities of the Boulder Canyon Project, and other financing methods fund the remainder. Western's overall average budgeted salary/benefit costs per FTE for FY 2009, FY 2010 and FY 2011 are $106,735, $111,289, and $119,758 respectively. More than 37 percent of Western's personnel salaries and compensation policies are determined through wage surveys and union negotiations (craft workers, power system dispatchers, schedulers, and marketers) and become effective at the beginning of a fiscal year rather than in January as do the General Schedule increases.

	FY 2009	FY 2010	FY 2011
Travel	**8,382**	**8,684**	**9,421**

Estimates, including $167,000 for the Boulder Canyon Project, include transportation and per diem allowances for day-to-day performance of duties of Federal staff, including crews who maintain the interconnected system. The remote and rural locations in Western's 15-State service area result in less competitive pricing. Rental/lease of GSA vehicles and other transportation estimates are also included. Estimates are based on historical costs and an assessment of planned activity. The slight increase is attributable to inflation, and an increase of planned travel activity.

	FY 2009	FY 2010	FY 2011
Support Services	**24,265**	**26,552**	**27,902**

Support services funded in this category include information processing, warehousing, job related training and education, engineering, miscellaneous advisory and assistance services, and general administrative support. The Boulder Canyon portion of the support services estimate totals $365,000. The increase to this activity is required to support Western's mission needs in environmental analysis of substation construction, training requirements in support of Western's succession planning, and ADP program support for Western's financial system. Other increases are primarily inflationary in nature offset by a slight decrease in administrative services.

	FY 2009	FY 2010	FY 2011
Other Related Expenses	**19,249**	**22,323**	**23,228**

Other related expenses include rental space, utilities, supplies and materials, telecommunications, personal computers, printing and reproduction, training tuition, and DOE's working capital fund

(dollars in thousands)

FY 2009	FY 2010	FY 2011

distribution. The Boulder Canyon portion of these expenses total $502,000. Rental space costs assume the General Services Administration's (GSA) inflation factor. Other costs are based on historical usage and actual cost of similar items. The increase is primarily attributable to administrative equipment maintenance expenses charged to this account, an increase to miscellaneous services which includes Western's guard service requirements, and a slight increase in tuition reimbursements. These increases are offset by a decrease in purchases from other Government accounts as well as a decrease in planned architectural and engineering services required in FY 2011.

	FY 2009	FY 2010	FY 2011
Total, Program Direction	**166,423**	**180,756**	**193,961**

Explanation of Funding Changes

	FY 2011vs. FY 2010 ($000)
Salaries and Benefits	
▪ The increase to salary and benefits includes Western's request for an increase of 7 FTE and supports the remaining FTE financed in this account, to include those salaries determined through negotiations.	+10,213
Travel	
▪ The increase to this activity includes inflationary factors and a slight increase in travel related to training for those employees hired under Western's 50-5-5 trainee program.	+737
Support Services	
▪ The increase to this activity is primarily attributable to economic and environmental analysis in support of Western's capital mission needs. Other increases include training and education as part of Western's succession planning, ADP support associated with Western's financial system upgrade, with the balance of increases being inflationary in nature. These increases are offset by a slight decrease to administrative requirements.	+1,350
Other Related Expenses	
▪ The increase is primarily attributable to administrative equipment maintenance expenses charged to this account, an increase in miscellaneous services which includes Western's guard service requirements, and a slight increase in tuition reimbursements. These increases are offset by decreases in purchases from other Government accounts as well as a planned architectural and engineering services required in FY 2011.	+905
Total Funding Change, Program Direction	**+13,205**

Support Services by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Technical Support			
Economic and Environmental Analysis	2,738	3,981	5,756
Test and Evaluation Studies	0	0	0
Total, Technical Support	2,738	3,981	5,756
Management Support			
Management Studies	0	0	0
Training and Education	1,006	1,161	1,485
Automated Data Processing	6,284	6,444	6,513
Reports and Analyses Management and General Administrative Services	14,237	14,966	14,148
Total, Management Support	21,527	22,571	22,146
Total, Support Services	24,265	26,552	27,902

Other Related Expenses by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Training	364	288	526
Working Capital Fund	1,174	1,159	1,117
Printing and Reproduction	104	118	116
Rental Space	1,858	2,303	2,316
Software Procurement/Maintenance Activities/Capital Acquisitions	3,940	3,695	4,339
Purchases from Government Accounts	1,131	976	560
Architectural and Engineering Services	2,889	2,961	2,213
Other Miscellaneous Expenses	7,789	10,823	12,041
Total, Other Related Expenses	19,249	22,323	23,228

Utah Mitigation and Conservation
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Utah Mitigation and Conservation Budget Authority	7,342	7,584	7,627
Total, Utah Mitigation and Conservation Budget Authority	7,342	7,584	7,627

Description

The Reclamation Projects Authorization and Adjustment Act of 1992, Title IV, established the Utah Reclamation Mitigation and Conservation Account (Account) in the Treasury of the United States. The purpose of this Account is to ensure that the level of environmental protection, mitigation, and enhancement achieved in connection with projects identified in the Act and elsewhere in the Colorado River Storage Project in the State of Utah is preserved and maintained. The Administrator of Western is authorized to deposit funds into the Account. Such expenditures are to be considered non-reimbursable and non-returnable. The Utah Reclamation Mitigation and Conservation Commission established under Title III of the Act, is authorized to administer all funds deposited into this Account.

Benefits

This Account provides for the preservation of fish and wildlife and recreation resources impacted by the Central Utah Project and the Colorado River Storage Project in the State of Utah.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Utah Mitigation and Conservation	**7,342**	**7,584**	**7,627**
A deposit of $7,627 thousand will be made to this Account.			
Total, Utah Mitigation and Conservation	**7,342**	**7,584**	**7,627**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Utah Mitigation and Conservation	
The increase is based on the required calculation using factors found in the Economic Assumptions, CPI-Urban Customers.	+43
Total Funding Change, Utah Mitigation and Conservation	**+43**

Falcon and Amistad Operating and Maintenance Fund

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Western Area Power Administration				
Falcon and Amistad Operating and Maintenance Fund	2,959	0	2,568	3,715
Less Offsetting Collections, Annual Expenses	0	0	-2,348	-3,495
Total, Falcon and Amistad Operating and Maintenance Fund	2,959	0	220	220
Reclassification of Mandatory Receipts to Discretionary Offsetting Collections	0	0	+2,348	0

Public Law Authorization:
Public Law 103-236, "Foreign Relations Authorization Act, Fiscal Years 1994 and 1995"
The Act of June 18, 1954 (68 Stat. 255)

Mission

The Falcon and Amistad Operating and Maintenance Fund (Maintenance Fund) was established in the Treasury of the United States as directed by the Foreign Relations Authorization Act, Fiscal Years 1994 and 1995. The Maintenance Fund is administered by the Administrator of Western for use by the Commissioner of the U. S. Section of the International Boundary and Water Commission (IBWC) to defray administrative, O&M, replacements, and emergency costs for the hydroelectric facilities at the Falcon and Amistad Dams.

Benefits

The Falcon-Amistad Project hydroelectric power generation plants sell generated power to rural electric cooperatives through Western. The United States' share of the generating capacity of the two power plants is 97.5 MW. All revenues collected in connection with the disposition of electric power generated at the Falcon and Amistad Dams, except monies received from the Government of Mexico, are credited to the Maintenance Fund. Any monies received from the Government of Mexico are credited to the General Fund of the U. S. Treasury. Revenues collected in excess of expenses are used to repay, with interest, the cost of replacements and original investments, thus supporting Western's Program Goal. Full funding will support 24-hour/day operation and maintenance of the two power plants to ensure response to ever-changing water conditions, customer demand, and continual coordination with operating personnel of the Government of Mexico. In addition, power will be marketed, repayment studies will be completed and revenues collected. The Federal staff funded under this program continues to be allocated to the U. S. Section of IBWC by the Department of State. Consistent with the authority provided in the 2010 Energy and Water Appropriations, the FY 2011 Budget provides funding for the annual expenses through discretionary offsetting collections derived from power receipts collected to recover those expenses.

Falcon and Amistad Operating and Maintenance Fund

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Falcon and Amistad Operating and Maintenance Fund			
Salaries and Benefits	1,965	2,019	2,505
Routine Services	803	392	1,015
Miscellaneous Expenses	176	142	179
Marketing, Contracts, Repayment Studies	15	15	16
Subtotal, Falcon and Amistad Operating and Maintenance Fund	2,959	2,568	3,715
Offsetting Collections, Annual Expenses	0	-2,348	-3,495
Total, Falcon and Amistad Operating and Maintenance Fund	2,959	220	220

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**1,965**	**2,019**	**2,505**

Salaries and benefits are provided for 42 positions of the U.S. Section of the IBWC who operate and maintain the two power plants on a 24-hour/day basis, including planned maintenance activities, required safety services, and emergency response to flood operations and/or equipment failure. The increase is attributed to promotions, salary and cost of living adjustments, and additional personnel.

Routine Services	**803**	**392**	**1,015**

Routine services such as inspection and service of the HVAC and air compressor systems, fire suppression systems, elevators, self-contained breathing apparatus, recharge and hydro-testing of fire extinguishers, calibration of test equipment, rebuild of electric motors, and repair of obsolete equipment when replacement parts are no longer available will be provided. The request includes capitalized estimates of $220 thousand to partially cover the expense of installing an Access Control System at both Falcon and Amistad power plants. At present, both Falcon and Amistad have weak physical security. Both power plants are considered soft targets, attractive to terrorists wishing to either enter the facility from the United States, Mexico, or the Rio Grande River. This leaves employees and area populations at risk. An access control system is needed as Falcon and Amistad power plants have been classified as Tier II facilities by the Department of Homeland Security.

Miscellaneous Expenses	**176**	**142**	**179**

Funding for IBWC employees and technical advisors, including travel, training, communications, utilities, printing, and office supplies and materials. Training activities include that which are essential to comply with standards of the Interagency Commission on Dam Safety (ICODS), Occupational and Health Administration (OSHA), and the National Dam Safety Act.

Marketing, Contracts, Repayment Studies	**15**	**15**	**16**

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Costs for marketing power, administration of power contracts, and preparation of rate and repayment studies are included. Based on accurate studies, staff ensures that power revenues are set at an appropriate level to recover annual expenses and meet repayment schedules.			
Total, Falcon and Amistad Operating and Maintenance Fund	**2,959**	**2,568**	**3,715**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits The increase is due to the addition of 7 FTE's to include more security guards and maintenance workers at both Falcon and Amistad power plants. Further increase is attributed to promotions, salary and cost of living adjustments.	+486
Routine Services The increase is due to an increase in operations and maintenance activities charged to this account.	+623
Miscellaneous Expenses The increase is due to inflation, an increase in utility estimates to include WAN services, and funding for employees to obtain Power Plant Technical Training Testing/Operations certification.	+37
Marketing, Contracts, Repayment Studies The increase is due to inflation.	+1
Total Funding Change, Falcon and Amistad, Operating and Maintenance Fund	**+1,147**

Colorado River Basins Power Marketing Fund

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Colorado River Basins Power Marketing Fund				
Equipment, Contracts and Related Expenses	195,137	0	212,766	174,734
Program Direction	45,147	0	48,957	52,569
Total, Operating Expenses from new authority	240,284	0	261,723	227,303
Offsetting Collections Realized	-263,284	0	-284,723	-250,303
Total, Obligational Authority	-23,000	0	-23,000	-23,000

Public Law Authorizations:
Public Law 75-529, "The Fort Peck Project Act of 1938"
Public Law 84-484, "The Colorado River Storage Project Act of 1956"
Public Law 90-537, "The Colorado River Basin Project Act of 1968"
Public Law 95-91, "Department of Energy Organization Act" (1977)

Mission

Western operates and maintains the transmission system for the projects funded in this account to ensure an adequate supply of reliable electric power in a clean and environmentally safe, cost-effective manner. The Colorado River Basins Power Marketing Program (Program) is comprised of the three power systems: the Colorado River Storage Project, including the Dolores and Seedskadee Projects; the Fort Peck Project, and the Colorado River Basin Project. This program is funded through Western's business-type revolving fund (Federal Enterprise Fund), the Colorado River Basins Power Marketing Fund.

Benefits

Western achieves continuity of service by maintaining its power systems at or above industry standards, rapidly restoring service following any system disturbance, mitigating adverse environmental impacts, performing clean-up activities, and maximizing the revenues gained from non-firm energy sales. In concert with its customers, Western reviews required replacements to its existing infrastructure to sustain reliable power delivery to its customers and to contain annual maintenance expenses.

Revenues from the sale of electric energy, capacity and transmission services replenish the fund and are available for expenditure for operation, maintenance, replacements, power billing and collection, program direction, purchase power and wheeling, interest, emergencies, and other power marketing expenses. Power sales and other revenues, which are collected in excess of expenses, are used to repay Federal investments to the U.S. Treasury. This request represents Western's estimate of obligations to finance these business-type operations.

Equipment, Contracts and Related Expenses
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Equipment, Contracts and Related Expenses			
Supplies, Materials, and Services	12,837	13,897	13,088
Purchase Power Costs	164,284	175,561	140,070
Capitalized Equipment	6,171	18,169	16,185
Interest/Transfers	11,845	5,139	5,391
Total, Equipment, Contracts and Related Expenses	195,137	212,766	174,734

Description

This program supports the Secretary's Energy Goal to build a competitive, low-carbon economy and secure America's energy future. Western ensures an adequate supply of reliable electric power in a safe, cost-effective manner, and achieves continuity of service throughout its service territory by maintaining its power system at or above industry standards, rapidly restoring service following any system disturbance, mitigating adverse environmental impacts, performing clean-up activities, and maximizing the revenues gained from ancillary services and cost-based non-firm energy sales.

Benefit

Western's equipment, contracts and related expenses are necessary to operate and maintain this activity. Revenues from the sale of electric energy, capacity and transmission services replenish the fund and are available for expenditure for operation, maintenance, power billing and collection, program direction, purchase power and wheeling, interest, emergencies, and other power marketing expenses.

Supplies and materials, such as wood poles, instrument transformers, meters and relays, must be procured to provide necessary resources to respond to routine and emergency situations in the high-voltage interconnected transmission system. Technical services, such as waste management disposal and pest/weed control, are used as needed.

Western's planned replacement and addition activity is based on an assessment of age and the maintenance frequency/problems of individual items of equipment, availability of replacement parts, safety of the public and Western's personnel, environmental concerns, and an orderly work plan. The work plans, coordinated with Western's customers who ultimately bear the burden of all Western expenses, reflect an overall sustainable level of effort, with shifts in emphasis between categories (i.e. electrical versus communication equipment) in any given year.

Electrical equipment replacements, such as circuit breakers, transformers, insulators, revenue meters, switches, control boards, relay and controls must be acquired to assure reliable service to Western's customers. System age and environmental concerns necessitate orderly replacement before significant problems develop.

Replacement and upgrade of microwave, SCADA, and other communication and control equipment continues to provide increased system reliability, and reduce maintenance and equipment costs.

Capitalized movable equipment such as special purpose vehicles (e.g., truck tractor, diggers), special purpose equipment (e.g., pole trailers, brush chippers), specialized test equipment (e.g., motion analyzers and relay test equipment), computer-aided engineering equipment, office equipment, IT equipment and software must be upgraded and replaced.

Electrical resources and transmission capability to firm up the Federal hydropower supplies needed to meet Western's contractual obligations will continue to be obtained. Transmission wheeling services are also purchased when a third party's transmission lines are needed to deliver Federal power to Western's customers.

Reimbursements to the U.S. Army Corps of Engineers for operation and maintenance of the Fort Peck Powerplant and planned interest payments to the U.S. Treasury are also included in this section.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Supplies, Materials, and Services	**12,837**	**13,897**	**13,088**

Supplies, materials, and services necessary to respond to routine and emergency situations in the high-voltage interconnected transmission system will be procured, and reimbursements to the U.S. Army Corps of Engineers for operation and maintenance of the Fort Peck Powerplant will continue. A well-maintained transmission system supports Western's attainment of reliability and transmission availability performance by preventing sudden failure, unplanned outages, and possible regional power system disruptions. By providing 24-hour/day reliable electric power delivery to its customers, Western secures revenues for repayment of the Federal investment. Safe working procedures are discussed before work begins to optimize public safety, Western personnel, and equipment. The request is based on projected work plans for activities funded from this Account. Estimates are based on historical data of actual supplies needed to maintain the transmission system reliably, including emergency situations such as ice storms and tornadoes. Costs are based on recent procurement of similar items. The decrease is primarily due to a slight decreased requirement in this activity.

	FY 2009	FY 2010	FY 2011
Purchase Power Costs	**164,284**	**175,561**	**140,070**

Electrical resources, transmission capability and wheeling services will be purchased. The request anticipates the continued low-steady-flow tests conducted at Glen Canyon Dam, as required by the Glen Canyon Dam Environmental Impact Statement Record of Decision. Additionally, amounts include obligational authority to accommodate replacement power purchases for customers served by the Colorado River Storage Project. The replacement power purchases, a provision of the Salt Lake City Area Integrated Projects electric power contracts, are made at the request of power customers at times Western lacks sufficient generation to meet its full contract commitment. The funds for the replacement power purchases are advanced by the requestors prior to the purchase. Anticipated purchase power budget estimates increase in FY 2009 as a result of increased power costs to Western, and an increase in delivered MWh.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Capitalized Equipment	**6,171**	**18,169**	**16,185**

Capitalized equipment including circuit breakers, transformers, relays, switches, transmission line equipment, microwave, SCADA, and other communication and control equipment, will be acquired to assure reliable service to Western's customers. Replacement and upgrade of aged power system components are crucial to system reliability and transmission availability performance. Removing environmental hazards and replacing aged equipment eliminates safety hazards for the public and Western's personnel. Planned communications equipment purchases increases and includes microwave upgrades from Phoenix to Mexican Hat, Buffalo Pass microwave building replacement, and facilities repairs and replacements for Montrose to Mexican Hat. Mobile radio replacements are also planned as the lifespan of these mobile radios have passed. The installation of fiber multiplex equipment is included in this estimate as fiber optic cables are installed on key backbone routes. Included also is funding for the continuation of the project to replace analog microwave with fiber optic ground wire and fiber optic terminal. Aged fiberglass communication buildings that have suffered extensive irreparable physical damage are also scheduled for replacement. Transmission line estimates decrease and include the purchase of poles, crossarms, conductors, overhead ground wire and hardware for the continued transmission line rebuilds.

Planned substation estimates include the funding request for a maintenance building to provide adequate facilities to house motorized and moveable equipment along with storage and shop areas and crew quarters for the personnel duty stationed at this location. The existing metal buildings were built in 1952 and have reached the end of their useful life and continue to have numerous problems. Replacement of oil breakers at Crossover and Vernal is also included as the parts are worn due to the number of operations. Also included is the replacement of a transformer at Circle. This unit is over 50 years old and is showing signs of insulation breakdown from oil analysis tests. Small oil leaks are beginning to show in the radiators which are difficult to fix. The upgrade of the 230-kV transfer equipment at Glen Canyon substation is also planned. Funding for the conversion of the 115-kV bus into a 230-kV 3-terminal ring bus, transformers, breakers, and control panels are requested due to the upgrade of the Charlie Creek-Watford City-Williston Transmission Line. Also included in this estimate is the complete rebuild of the Shiprock substation access road. In addition, replacements of transformer monitors at various substations are also planned. Western is beginning the fifth year of a 10-year program to replace older electro-mechanical relays with microprocessor relays due to aged equipment. The microprocessor relays will assist in finding faults faster in order to more efficiently restore service to the customer. Other miscellaneous items required for substation replacements include surge arrestors, batteries and chargers, and monitoring equipment.

Planned movable capitalized property estimates increase only slightly and include the replacement of a front end loader at Montrose to access road repair and maintenance on transmission line right of ways, special purpose trucks at Havre and Ft. Peck, a caterpillar vehicle at Fort Peck as the existing unit is 35 years old and in need of replacement. The existing trucks and vehicles being replaced have reached the end of their useful life and require major transmission rebuilds, of which parts are not readily available. Also requested is a new Ag Tractor as the existing 1985 unit has been a maintenance issue for several years and has hydraulic, transmission, and differential problems making the unit extremely costly to

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

maintain. This unit has been out of production for 15 years and needs to be replaced. Other estimates include the replacement of outdated test equipment, and test equipment to troubleshoot the new digital microwave radio system. Ongoing replacement is also planned for aging information technology support systems and routers. The dependability of this equipment is nearing the uncertainty mark and reaching vendor end of life. Other requests include funding for the continuation SCADA Upgrade program, SCADA system software and hardware procurements for the Operations Consolidation Project, as well as other small minor enhancements that provide for the ease of maintenance, protection of equipment and materials, and environmental compliance.

	FY 2009	FY 2010	FY 2011
Interest/Transfers	**11,845**	**5,139**	**5,391**

Interest payments to the U.S. Treasury will occur. Estimates are based on Power Repayment Studies for the Projects funded in this account. The projected interest payment increases in FY 2011 primarily due to an increase in investment and a reduction in principal payments made from the prior years estimated Power Repayment Study.

	FY 2009	FY 2010	FY 2011
Total, Equipment, Contracts and Related Expenses	**195,137**	**212,766**	**174,734**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Supplies and Materials	
▪ The decrease is attributable to a slight change of requirements in this activity.	-809
Purchase Power Costs	
▪ Purchase power costs decrease in FY 2011 as a result of the anticipated improvement of water conditions and a decrease in the costs of purchase power.	-35,491
Capitalized Equipment	
▪ The decrease in capitalized equipment purchases is primarily attributed to a decreased level of purchases associated with planned replacement of substation equipment offset by a slight increase in replacement of transmission line hardware.	-1,984
Interest	
▪ Planned interest payment to the U.S. Treasury in FY 2011 increases due to increase in investment and a reduction in principal payments made from the prior years estimated Power Repayment Study.	+252
Total Funding Change, Equipment, Contracts and Related Expenses	**-38,032**

Program Direction

Funding Profile by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Program Direction			
Salaries and Benefits	32,113	34,845	38,200
Travel	2,362	2,990	2,793
Support Services	5,338	5,653	5,466
Other Related Expenses	5,334	5,469	6,110
Total, Program Direction	45,147	48,957	52,569
Full Time Equivalents	272	291	297

Mission

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Colorado River Basins Power Marketing Fund. Western trains its employees on a continuing basis in occupational safety and health regulations, policies and procedures, and conducts safety meetings at employee, supervisory and management levels to keep the safety culture strong. Accidents are reviewed to ensure lessons are learned and proper work protocol is in place.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Salaries and Benefits	**32,113**	**34,845**	**38,200**

Salaries and benefits will be provided for Federal employees who operate and maintain the Program's high-voltage integrated transmission system and associated facilities; plan, design, and supervise the replacement (capital investments) to the transmission facilities; and market the power and energy produced to repay annual expenses and capital investment. Engineers and craft workers rapidly restore the transmission system, comprised of approximately 4,000 circuit-miles of transmission lines and associated substations, switchyards, communication, control and general plant facilities, following any disturbance. Staff routinely maintain and/or replace equipment to assure capability for reliable power delivery. Dispatchers respond to minute-by-minute changes to load and generation to meet or exceed the NERC and industry averages. Energy schedulers maximize revenues from non-firm energy sales, and power rates are reviewed and adjusted, thereby supporting the repayment of Federal investment. Staff provides continuing services such as system operations, power billing and collection, power marketing, energy services, technology transfer, environmental, safety, security and emergency management activities. Due to the extreme hazards associated with a high-voltage electrical system, staff makes safety a priority in each and every task. Staff evaluates general power resources, collaborating and planning with customers and members of the interconnected transmission system to

(dollars in thousands)

FY 2009	FY 2010	FY 2011

identify the most effective transmission system improvements to maximize benefits to all participants.

The 297 FTE supported in this account reflects both direct and indirect (portions of administrative and general expense employees). Amounts are based on planned work associated with facilities funded through this Account and not on specific positions; therefore, FTE numbers may vary from year to year. The funding increase supports the increase of within target FTE and reflects anticipated salary and within-grade increases. As authorized in P.L. 99-141, Western annually establishes pay rates and compensation policy for some employees (craft workers, power system dispatchers, schedulers, and marketers) based on prevailing rates in the electric utility industry. Due to recruitment/retention issues for those occupations across the Nation and increased staff in these categories to meet the additional workload requirements attributed to FERC Order Nos. 888 and 889, Western's Federal salary/benefit costs for the dispatching/scheduling functions increase at varying rates.

Travel **2,362** **2,990** **2,793**

Transportation/per diem allowances for day-to-day performance of duties of Federal staff, including crews maintaining the transmission facilities will continue. Rental/lease of GSA vehicles and transportation of things are also included. Estimates are based on historical travel costs, adjusted for inflation and planned activity. Decreased levels are attributable to a slight decrease in anticipated planned travel, offset by inflationary factors.

Support Services **5,338** **5,653** **5,466**

Support services funded in this category include IT support, warehousing, computer-aided drafting/engineering, and general administrative support. The increase is attributed to inflationary factors, an increase in overhead distribution charged to this account, a slight increase in job related training, offset by a decrease to ADP and administrative support.

Other Related Expenses **5,334** **5,469** **6,110**

Other related expenses include, but are not limited to, DOE's working capital fund distribution, space, utilities and miscellaneous charges, printing and reproduction, training tuition, maintenance of office equipment, supplies and materials, telecommunications, personal computers, and multi-project costs. Intermittent specialized services, not included in on-going support service contracts, are also included. Rental space costs assume the GSA inflation factor. Other costs are based on historical usage and actual cost of similar items. The request reflects inflationary increases, as well as increases from Western's overhead distribution, communications, miscellaneous contractual support, utility costs, and office equipment purchases.

Total, Program Direction **45,147** **48,957** **52,569**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits	
▪ Increase in salaries and benefits is attributed to the increase in FTE charged to this account, as well as salary and within grade increases, including salaries determined by prevailing rates in the electric utility industry.	+3,355
Travel	
▪ Decreased levels are attributable to a slight decrease in anticipated planned travel, offset by inflationary factors.	-197
Support Services	
▪ The decrease is primarily attributed to a slight decrease to Administrative Support Services and ADP support directly charged to this account.	-187
Other Related Expenses	
▪ The request reflects inflationary increases, as well as slight increases in the distribution from DOE's Working Capital Fund, maintenance activities and office equipment purchases, offset by a slight decrease in A&E services.	+641
Total Funding Change, Program Direction	**+3,612**

Support Services by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Technical Support			
Economic and Environmental Analysis	0	0	0
Test and Evaluation Studies	0	0	0
Total, Technical Support	0	0	0
Management Support			
Management Studies	0	0	0
Training and Education	241	297	319
ADP Support	1,246	1,290	1,259
Administrative Support	3,851	4,066	3,888
Total, Management Support	5,338	5,653	5,466
Total, Support Services	5,338	5,653	5,466

Other Related Expenses by Category

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Training	31	30	28
Working Capital Fund	204	268	305
Printing and Reproduction	29	29	26
Rental Space	743	806	813
Software Procurement/Maintenance Activities/Capital Acquisitions	796	545	1,167
Other Services	3,531	3,791	3,771
Total, Other Related Expenses	5,334	5,469	6,110

Estimate of Gross Revenues [a]

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Boulder Canyon Project	84,561	84,894	81,718	83,897	85,283	82,682	85,119
Central Valley Project	390,711	386,062	407,581	420,279	440,548	440,548	440,548
Central Arizona Project [b]	122,242	122,242	122,242	122,242	122,242	122,242	122,242
Falcon-Amistad Project	4,809	4,814	4,813	4,813	4,812	4,811	4,811
Fryingpan-Arkansas Project	17,063	17,770	16,795	16,795	16,795	16,741	16,741
Pacific Northwest-Southwest Intertie Project	30,570	31,000	31,859	32,719	33,578	34,433	34,433
Parker-Davis Project	53,937	54,257	54,253	54,248	54,243	54,238	54,232
Pick-Sloan Missouri Basin Program	448,134	523,878	514,476	520,201	533,324	533,115	533,429
Provo River Project	300	285	289	297	304	312	312
Washoe Project	780	828	829	850	882	852	852
Salt Lake City Area Integrated Projects	167,437	181,504	182,304	182,304	182,304	182,492	182,492
Financial statement adjustments							
Total, Gross Revenues	1,320,544	1,407,534	1,417,159	1,438,645	1,474,315	1,472,466	1,475,211

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[a] For most power systems, amounts are based on the FY 2008 Final Power Repayment Studies (PRS). The Central Arizona Project (CAP) amounts shown are estimated projections.

[b] Western has contracted with the Salt River Project (SRP) to act as the scheduling entity and operating agent for CAP's portion of the Navajo Generating Station's output (547 MW). In return, as Western retains marketing responsibility, SRP agreed to pay monthly costs to cover annual expenses.

Estimate of Energy Sales[a]

(in gigawatthours)[b]

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
Boulder Canyon Project	3,772	4,047	4,069	4,076	4,081	3,958	3,897
Central Valley Project	8,954	9,053	9,091	9,314	9,549	9,796	10,055
Central Arizona Project	4,357	4,357	4,357	4,357	4,357	4,357	4,357
Falcon-Amistad Project	141	141	141	141	141	141	141
Loveland Area Projects[c]	2,123	2,123	2,123	2,123	2,123	2,123	2,123
Pacific Northwest-Southwest Intertie Project[d]	0	0	0	0	0	0	0
Parker-Davis Project	1,425	1,425	1,425	1,425	1,425	1,425	1,425
Pick-Sloan Missouri Basin Program, Eastern Division	8,742	8,742	8,763	8,763	8,763	8,763	8,763
Provo River Project	22	22	22	22	22	22	22
Washoe Project	12	12	12	12	12	12	12
Salt Lake City Area Integrated Projects[e]	5,431	5,390	5,433	5,433	5,433	5,433	5,433
Total	34,979	35,312	35,436	35,666	35,906	36,030	36,228

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[a] For most power systems, sales amounts are based on FY 2008 Power Repayment Studies (PRS). The estimates for Central Arizona, Falcon-Amistad, and Provo River projects are typically based on average sales over the prior five years.

[b] One gigawatthour (GWh) equals one million kilowatt-hours (kWh).

[c] Loveland Area Projects include Fryingpan-Arkansas Project and the Western Division of the Pick-Sloan Missouri Basin Program.

[d] Pacific Northwest-Southwest Intertie shows no energy sales, but reflects revenues from the transmission of energy (refer to the Estimate of Revenues table). The Intertie Project is for transmission of energy only.

[e] Salt Lake City Area Integrated Projects include the Colorado River Storage Project, Collbran Project, Rio Grande Project, Seedskadee Project, and Dolores Project.

Estimate of Proprietary Receipts

(dollars in thousands)

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
MANDATORY							
Falcon Amistad Maintenance Fund, 895178	2,959	220	220	220	220	220	220
Sale and transmission of electric power, Falcon and Amistad Dams, 892245	1,600	2,228	1,098	975	846	710	572
Sale of Power and Other Utilities Not Otherwise Classified, 892249	18,807	30,000	30,000	30,000	30,000	30,000	30,000
Sale of Power–Western–Reclamation Fund, 895000.27	172,844	58,236	94,241	102,415	116,479	105,401	111,350
Total, Mandatory Receipts	196,210	90,684	125,559	133,610	147,545	136,331	142,142
DISCRETIONARY							
Offsetting Collections from the recovery of power related expenses – Western – 89X5068.01	248,509	349,807	350,919	359,808	367,070	368,628	376,199
Less Purchase Power and Wheeling expenses	-248,509	-349,807	-350,919	-359,808	-367,070	-368,628	-376,199
Subtotal, 89X5068.01	0	0	0	0	0	0	0
Offsetting Collections from the recovery of annual expenses – Western - 89X5068.91[a]	0	147,530	180,306	185,983	186,970	192,848	198,929
Less Operating and Maintenance expenses	0	-37,038	-31,270	-32,008	-32,644	-33,358	-34,093
Less Program Direction expenses	0	-110,492	-149,036	-153,975	-154,326	-159,490	-164,836
Subtotal, 89X5068.91	0	0	0	0	0	0	0
Offsetting Collections from the recovery of power related expenses – Falcon Amistad Maintenance – 89X5178 [b]	0	2,348	3,495	3,618	3,746	3,881	4,019
Less Operating and Maintenance expenses	0	-2,348	-3,495	-3,618	-3,746	-3,881	-4,019
Subtotal, 89X5178	0	0	0	0	0	0	0
Subtotal, Discretionary Receipts	0	0	0	0	0	0	0
TOTAL, PROPRIETARY RECEIPTS	196,210	90,684	125,559	133,610	147,545	136,331	142,142

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[a] Pursuant to the Energy and Water Development and Related Agencies Appropriations Act, 2010, the FY 2010, FY 2011, and outyear receipt estimates reflect that receipts associated with annual expenses of this account are reclassified from mandatory to discretionary.

[b] Pursuant to the Energy and Water Development and Related Agencies Appropriations Act, 2010, the FY 2010, FY 2011, and outyear receipt estimates reflect that receipts associated with annual expenses of the Falcon and Amistad Operating and Maintenance Fund are reclassified from mandatory to discretionary.

Status of Treasury Borrowing

(dollars in millions)

	Direct Financing with Treasury		
	FY 2009	FY 2010	FY 2011
Total Legislated Treasury Borrowing Authority	3,250	3,250	3,250
Start-of-Year – Total Borrowing Authority Available	3,250	3,250	3,103
Annual Activity [a]			
Annual Borrowing Plan	0	-147	-914
Repayment	0	0	0
Subtotal, Annual Activity	0	-147	-914
Total, Remaining Treasury Borrowing Authority	3,250	3,103	2,189

The accompanying notes are an integral part of the table.

Western's estimate for the use of borrowing authority is comprised of funding for the construction schedules of projects selected to date, as impacted by interest rates and other cash management factors. In executing our mandate under the Recovery Act, as projects are added the estimates will be updated in subsequent reporting periods to reflect an accurate balance of legislated borrowing authority.

Borrowing authority will fund the construction of infrastructure by Western or our external partners(s). When work is performed by our partners, Western will report only the direct financing with Treasury. When work is performed internally, Western will use existing financial system and related accounting and business rules to isolate project obligations and expenditures, and will expand the table to incorporate this information. Western will also isolate project revenues in the same manner. Any and all reporting will be available at the individual project level, but reported cumulatively in the table above.

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[a] Amounts shown for annual borrowing plan and repayment are estimates.

Bonneville Power Administration

Bonneville Power Administration

Proposed Appropriations Language

Expenditures from the Bonneville Power Administration Fund, established pursuant to Public Law 93-454, are approved for [the Leaburg Fish Sorter, the Okanogan Basin Locally Adapted Steelhead Supplementation Program, the Crystal Springs Hatchery Facilities, and, in addition, for] official reception and representation expenses in an amount not to exceed [$1,500]*$3,000.*
During fiscal year 2011, no new direct loan obligations may be made.

Explanation of Changes

Proposed FY 2011 appropriation language increases the annual limit on BPA reception and representation expenditures to $3,000 per year.

The proposed appropriations language restricts new direct loans in FY 2011 as in FY 2010.

Bonneville Power Administration

Overview

Summary by Program

(accrued expenditures in thousands of dollars)

	FY 2009	FY 2010	FY 2011
CAPITAL INVESTMENTS			
Power Services	185,335	262,379	272,808
Transmission Services	192,731	450,498	462,213
Capital Equipment & Bond Premium	31,092	23,723	23,889
Total, Capital Investments	409,158	736,600	758,910
Accrued expenditures will require budget obligations of	409,158	736,600	758,910
Operating Expenses	2,410,146	2,983,698	3,219,446
Projects Funded in Advance	184,000	77,403	77,179
Capital Transfers (cash)	432,019	459,829	386,870
BPA Net Outlays	234,000	(10,000)	(10,000)
BPA Staffing (FTE)	3,021	3,100	3,100

Outyear Summary

(accrued expenditures in thousands of dollars)

	FY 2012	FY 2013	FY 2014	FY 2015
CAPITAL INVESTMENTS				
Power Services	278,470	288,682	290,409	294,266
Transmission Services	526,854	437,557	394,952	428,746
Capital Equipment & Bond Premium	28,782	28,923	29,297	29,884
Total, Capital Investments	834,106	755,162	714,658	752,896
Accrued expenditures will require budget obligations of	834,106	755,162	714,658	752,896
Operating Expenses	3,343,947	3,531,188	3,614,487	3,683,485
Projects Funded in Advance	78,060	78,099	78,137	59,231
Capital Transfers (cash)	332,261	197,364	150,700	90,958
BPA Net Outlays	(10,000)	(10,000)	(10,000)	(10,000)
BPA Staffing (FTE)	3,100	3,100	3,100	3,100

Overview

The accompanying notes are an integral part of this table.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Estimated Net Outlays could change due to changing market conditions, streamflow variability, and ongoing changes in the electric industry.

Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the NW Power Act are also assumed.

The cumulative amount of actual advance amortization payments as of the end of FY 2009 is $2,536 million.

FTE outyear data are estimates and may change.

Preface

The Bonneville Power Administration (Bonneville or BPA) serves the Pacific Northwest through operating an extensive electricity transmission system and marketing wholesale electrical power at cost from Federal dams and other non-Federal generating units including some wind energy generation facilities.

The organization of Bonneville's FY 2011 budget reflects Bonneville's business services basis for utility enterprise activities. Bonneville's two major areas of activity on a consolidated budget and accounting basis include Power Services (PS) and Transmission Services (TS) with administrative costs included. The PS includes line items for Fish and Wildlife, Conservation and Energy Efficiency, Residential Exchange Program (REP), Associated Projects O&M Costs, and Northwest Power and Conservation Council (Planning Council, Council).

Mission

The strategic mission of Bonneville as a public service organization is to create and deliver the best value for its customers and constituents as it acts in concert with others to assure the Pacific Northwest:

- An adequate, efficient, economical and reliable power supply;
- A transmission system that is adequate to the task of integrating and transmitting power from Federal and non-Federal generating units, providing service to BPA's customers, providing interregional interconnections, and maintaining electrical reliability and stability; and
- Mitigation of the Federal Columbia River Power System (FCRPS) impacts on fish and wildlife.

As BPA shapes programs and plans spending levels, it is driven by its strategic vision that encompasses the following four pillars:

- High reliability;
- Low rates consistent with sound business principles;
- Responsible environmental stewardship; and
- Accountability to the region.

Bonneville is committed to cost-based rates and public and regional preference in its marketing of power. Bonneville will set its rates as low as possible consistent with sound business principles and the full recovery of all of its costs, including timely repayment of the Federal investment in the system.

Benefits

Bonneville provides electric power (about one third of the electricity consumed in the region), transmission (about three-fourths of the region's high voltage transmission capacity), and energy efficiency throughout the Pacific Northwest, a 300,000 square mile service area that includes a population of about 12.3 million people. Bonneville markets the electric power produced from 31 operating Federal hydro projects in the Pacific Northwest owned by the U.S. Army Corps of Engineers (Corps) and the U.S. Department of Interior, Bureau of Reclamation (Reclamation), and also acquires non-Federal power, including the power from the Columbia Generating Station (CGS), to meet the needs of its customer utilities. Bonneville owns and operates over 15,000 circuit miles of transmission lines, 259 substations and associated power system control and communications facilities over which this electric power is delivered. Bonneville also has capital leases for certain transmission facilities. Bonneville also supports the protection and enhancement of fish and wildlife, and provides leadership in conservation and renewables development, as part of its efforts to preserve and balance the economic and environmental benefits of the FCRPS.

Bonneville's strategic direction establishes the agency's most important long-term objectives and the actions that will help it manage to these objectives. The strategic direction is advanced by BPA consistent with its three core values: trustworthy stewardship of the FCRPS, collaborative relationships, and operational excellence.

American Recovery and Reinvestment Act of 2009

In the American Recovery and Reinvestment Act of 2009 (ARRA), Section 401 provides for an increase in the amount of BPA's Treasury bonds that may remain outstanding at any given time under the Federal Columbia River Transmission System Act (Transmission System Act). This $3.25 billion increase in the limit on BPA's available Treasury bonds gives BPA the certainty of sufficient access to capital to proceed with planned new projects and ensures that existing capital projects will be able to proceed as planned.

Construction has begun on the $343 million West of McNary Reinforcements Group 1 (known as McNary-John Day), which will be funded by the increased Treasury borrowing authority through the ARRA. The project is expected to create between 100-200 construction jobs at its peak and provide transmission for over 575 MWs of wind energy, once energized in 2012. The project supports regional economic recovery efforts and the integration of wind development in the Northwest.

BPA is also moving ahead with environmental reviews under National Environmental Policy Act (NEPA) for three additional high-voltage transmission lines to meet load growth and facilitate renewable resource development needs throughout the Northwest. These projects and other capital investments in this FY 2011 budget support BPA's power generation, transmission, fish and wildlife, conservation, and renewable resources efforts.

BPA is committed to assuring that BPA's actions contribute to and support the Administration's goals under the ARRA. Integration of renewable energy sources onto the electrical grid helps the economic recovery efforts through clean, secure and affordable energy sources. See the Department of Energy (DOE) Recovery website (http://www.energy.gov/recovery/index.htm) as a source for up to date information.

Contribution to the Secretary's Priorities

DOE's five Secretarial priorities are Science and Discovery, Clean Energy, Economic Prosperity, National Security and Legacy, and Lower Green House Gas Emissions. Bonneville's Government Performance Results Act (GPRA) Unit Program Goal, to Market and Deliver Federal Power, supports DOE's Economic Prosperity priority.

GRPA Unit Program Goal 01.03.18.00: Bonneville Power Administration. Market and Deliver Federal Power: Ensure Federal hydropower is marketed and delivered while passing the North American Electric Reliability Corporation's (NERC) control compliance ratings, meeting planned repayment targets, and achieving targeted hydropower generation efficiency performance.

Contribution to GPRA Unit Program Goal 01.03.18.00: BPA. Market and Deliver Federal Power

Bonneville contributes to this strategic goal through its strategic vision to advance a Northwest power system that is a national leader in providing reliability, low rates consistent with sound business principles, environmental stewardship, and accountability to the region. For FY 2010, BPA is continuing its emphasis on performance with over 25 Key Agency Targets designed to measure progress toward achieving its business objectives. These objectives are focused within four interrelated perspectives: stakeholder value, financial performance, internal operations, and people and culture. Bonneville's infrastructure investments in the Pacific Northwest to meet power and transmission needs continue to support DOE's strategic goal on energy infrastructure.

Bonneville's strategic direction has helped to identify a number of key long-term issues. These issues center on providing Bonneville customers with certainty over load service obligations and enabling customers and the market to respond with the necessary electric industry infrastructure investments. Other key strategic interests include general market stability, BPA risk management, and long-term assurance of funding to repay the U.S. Treasury (Treasury) investment in infrastructure.

Annual Performance Targets and Results

Secretarial Goal: Economic

GPRA Unit Program Goal: Bonneville Power Administration

<table>
<tr><th>FY 2006</th><th>FY 2007</th><th>FY 2008</th><th>FY 2009</th><th>FY 2010</th><th>FY 2011</th><th>FY 2012</th><th>FY 2013</th><th>FY 2014</th><th>FY 2015</th></tr>
<tr><td colspan="10">System Reliability Performance Measure: Attain average North American Electric Reliability Corporation (NERC) compliance ratings for the following NERC Control Performance Standards (CPS) measuring the balance between power generation and load, including support for system frequency: (1) CPS1, which measures generation/load balance on one-minute intervals (rating > or =100); and (2) CPS2, which limits any imbalance magnitude to acceptable levels (rating > or =90). See note on FY 2010 CPS-2 target on p. 8.</td></tr>
<tr><td>T: CPS1>100, CPS2>90
A: CPS1 193.3, CPS2 96.1</td><td>T: CPS1>100, CPS2>90
A: CPS1 193.9, CPS2 96.01</td><td>T: CPS1>100, CPS2>90
A: CPS1 191.4, CPS2 95.0</td><td>T: CPS1>100, CPS2>90
A: CPS1 192.5, CPS2 95.9</td><td>T: CPS1>100,
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A:</td><td>T: CPS1>100, CPS2>90
A:</td><td>T: CPS1>100, CPS2>90
A:</td></tr>
<tr><td colspan="10">Hydropower Generation Efficiency: Achieve > or = 97.5% Heavy-Load-Hour Availability (HLHA) through efficient performance of Federal hydro-system processes and assets, including joint efforts of BPA, Army Corps of Engineers, and Bureau of Reclamation. HLHA is actual machine capacity available during heavy-load hours (0700-2200 Monday-Saturday), divided by planned available capacity during heavy-load hours.</td></tr>
<tr><td>T: >=97%
A: 100%</td><td>T: >=97%
A: 99.6%</td><td>T: >=97.5%
A: 98.8%</td><td>T: >=97.5%
A: 100.2%</td><td>T: >=97.5%
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A:</td><td>T: >=97.5%
A:</td><td>T: >=97.5%
A:</td></tr>
<tr><td colspan="10">Repayment of Federal Power Investment Performance: Meet planned annual repayment of principal on Federal power investments.</td></tr>
<tr><td>T: $304 million
A: $646 million</td><td>T: $387 million
A: $618 million</td><td>T: $409 million
A: $555 million</td><td>T: $276 million
A: $432 million</td><td>Meet planned annual repayment of principal on Federal power investments.</td><td>Meet planned annual repayment of principal on Federal power investments.</td><td>Meet planned annual repayment of principal on Federal power investments.</td><td>Meet planned annual repayment of principal on Federal power investments.</td><td>Meet planned annual repayment of principal on Federal power investments.</td><td>Meet planned annual repayment of principal on Federal power investments.</td></tr>
</table>

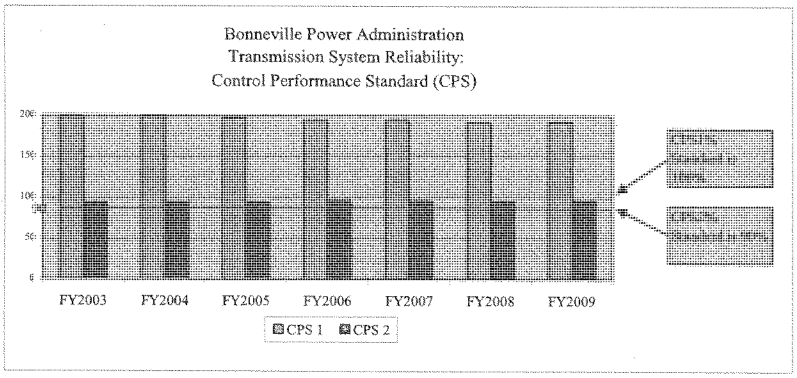
Transmission System Reliability Performance Indicator

This indicator defines a standard of minimum monthly control performance as established by the NERC. Each control area within the system is to operate above minimum monthly control compliance ratings that can be achieved within the bounds of reasonable economic and physical limitations. Each control area is to monitor its control performance continuously against two standards, CPS 1 and 2.

The CPS-1 and CPS-2 performance indicators are industry standards that U.S. and Canadian electric utilities use in conjunction with NERC to help assure the reliability of the North American high voltage distribution system, and thereby to benefit the public. These measures are intended to indicate whether or not electric utility systems are being operated within acceptable operating parameters. Any deviation from the minimum standards must be reported to NERC. CPS-1 helps assure generation and load balance. CPS-2 helps limit the magnitude of any imbalance to acceptable levels, and provides a frequency sensitive evaluation of how well a control area meets its demand requirements.

Transmission System Reliability Target in FY 2011: Attain average NERC compliance ratings for the following NERC CPS measuring the balance between power generation and load, including support for system frequency: (1) CPS-1, which measures generation/load balance on one-minute intervals (rating >= 100); and (2) CPS-2, which limits any imbalance magnitude to acceptable levels (rating >=90).

Note: As part of the Western Electricity Coordinating Council (WECC) field trial of NERC's Reliability Based Control (RBC) draft standard beginning in FY 2010, BPA will not report CPS-2 to DOE for FY 2010 because the RBC and CPS-2 standards are mutually exclusive (only one of these standards can be in effect at the same time). After the RBC field trial, BPA will reevaluate the use of CPS-2 for FY 2011 forward.



Repayment of Federal Power Investment Performance Indicator

This indicator measures the variance of actual from planned principal payments to the Treasury.

Treasury payment outyear estimates for planned amortization of principal are based on rate case estimates when available and planned amortization for future rate case periods. These estimates may change due to revised capital investment plans, actual Treasury borrowing, and advanced amortization payments. Bonneville made its full FY 2009 payment of $845.1 million to the Treasury comprised of $432 million in amortization that includes $234 million in advanced amortization, $366.8 million in interest, and $46.3 million of unfunded CSRS liabilities and other costs.

Repayment target in FY 2011 – Meet planned repayment of principal on Federal power investments in FY 2011.

The following chart displays principal repayment only.

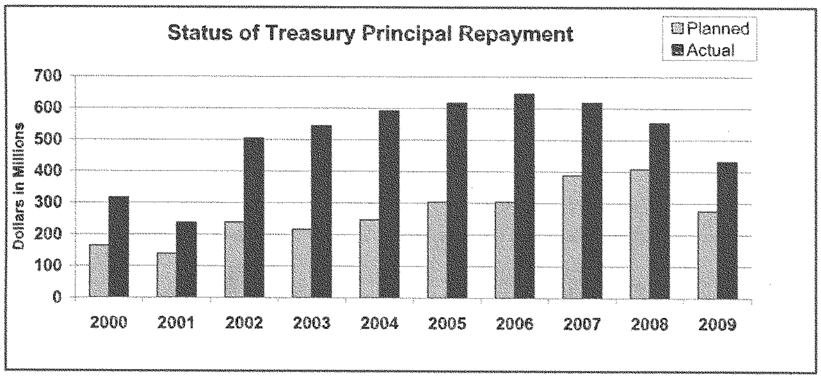


Chart Notes:

FYs 2000 - 2009 payments include portions of future planned amortization amounts consistent with BPA's capital strategy plan and debt optimization.
Advance amortization due to sale of low-voltage transmission facilities includes $13 million and $5.3 million in FYs 2003 and 2006, respectively.

For FYs 2007 - 2009, the planned repayment of principal of Federal power investment reflects the amounts calculated in Bonneville's 2007 Power Rate Case and 2006 and 2008 Transmission Rate Cases that were scheduled to be the lowest level of amortization satisfying the repayment requirements. This display of planned repayment of principal is consistent with all prior years shown on the table. The rate cases also included some amount of advanced repayment of principal to the U.S. Treasury that resulted from BPA's debt optimization program, which involved restructuring Energy Northwest (EN) debt.

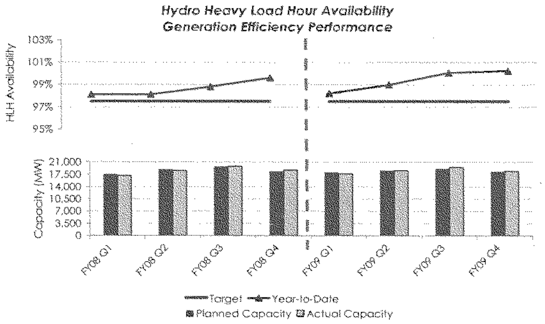
Hydropower Generation Efficiency Performance Indicator

The fundamental programmatic role of Bonneville within the FCRPS is the marketing of electricity generated at the multi-purpose hydro projects in the Pacific Northwest owned and operated by the Corps and Reclamation. Heavy Load Hour Availability (HLHA) concerns the actual effective performance of the hydro system, reflecting joint work between BPA, the Corps, and Reclamation to improve performance of these generating projects when generation is needed most for commercial power operation. It is important from a reliability and economic standpoint to have power generation available when loads are high.

HLHA is the ratio of actual available machine capacity during heavy load hours, divided by planned available capacity during heavy load hours, expressed as a percentage.

Actual available machine capacity is measured directly from data supplied from the hydro plants. Planned available capacity is established annually through the Annual Outage planning process, then updated quarterly based on changes in load and water forecasts. The resulting outage plans are stored in BPA's Outage Database.

> Hydropower Generation Efficiency target: Achieve actual efficiency results at or above planned availability target levels for hydropower generation efficiency.



As represented above, FCRPS hydro performance tracked very closely to the HLHA targets for all four quarters of FY 2009.

Means and Strategies

Bonneville provides electric power, transmission and energy services while supporting the achievement of its vital responsibilities for fish and wildlife, energy conservation, renewable resources and low-cost power in the Pacific Northwest.

BPA's strategic direction and balanced scorecard establish a key objective of meeting electricity availability, adequacy, reliability and cost-effectiveness standards through power and transmission performance, and expansion of the transmission system. The strategic direction and balanced scorecard efforts include a long-term vision of Bonneville's future and an assessment of critical environment factors and key objectives. The vision and assessment help direct Bonneville activities needed to meet its mission over the long term. The objectives are supported by multi-year targets to lay out the long-term course for achieving the objectives.

To improve system adequacy, reliability and availability, BPA has embarked on major transmission infrastructure projects. The projects shore up the region's transmission system and help deliver the region's future power needs. These projects address multiple challenges, such as integration of renewable energy, the need to relieve a number of congested transmission paths, the pressure to keep up with growing energy demands and the need to meet BPA's open access policy in support of competitive markets.

For FY 2011, BPA's total transmission capital budget includes a total of $539 million for main grid additions, upgrades and additions, system replacements, area and customer services, and projects funded in advance (PFIA). These investments, repaid entirely by revenues from BPA's transmission customers or benefiting third parties, are fundamental to BPA's transmission performance.

As part of BPA's strategic direction, Bonneville is also working to improve efficiency and initiate further cost reductions. Bonneville coordinates its power operational activities with the Corps, Reclamation, NERC, regional electric reliability councils, its customers, and other stakeholders to provide the most efficient use of Federal assets. Ongoing work with the Corps and Reclamation is focused on improving the reliability of the FCRPS, increasing its generation efficiency, and optimization of hydro facility operation.

In addition, Bonneville is committed to continue funding efforts to recover listed fish and wildlife species in the Columbia Basin under the Endangered Species Act (ESA) and to work closely with the Council, regional fisheries managers, and other Federal agencies to prioritize and manage fish and wildlife program projects.

Bonneville initiatives are impacted by external factors such as continually changing economic and institutional conditions, competitive dynamics, and ongoing changes in the electric industry.

Private and public sector partners have been and continue to be an important part of BPA's collaborative efforts to promote and foster efficient use of energy. BPA has initiated efforts to explore non-Federal financial participation in its transmission infrastructure projects with transmission customers and others in the region. Additionally, BPA has partnered and assisted with a DOE Wind Power crosscutting initiative to strengthen energy security by adding alternative sources of renewable energy.

Additional activities and products contributing to BPA's long-term achievement of its mission include implementing the Regional Dialogue, an enhanced capital asset management plan, a workforce plan that addresses the long-term staffing needs of the agency, and continued efforts to increase operational efficiencies. A separate Technology and Innovation office within BPA leads the long-term strategy development and management for research, development, demonstration and deployment of new technology by BPA.

Validation and Verification

To validate and verify program performance, Bonneville conducts various internal and external reviews and audits. Bonneville's programmatic activities are subject to review by Congress, the U.S. Government Accountability Office (GAO), the Department's Inspector General, and other governmental entities. Bonneville accounts and financial statements are reviewed annually by an independent outside auditor. Bonneville has received a clean audit opinion since the mid-1980s and no material weaknesses have been identified in controls over financial reporting.

Program Perspectives

This section provides an introduction to Bonneville operations and statutory authorities followed by a description of ongoing activities.

Introduction

Bonneville is DOE's electric Power Marketing Administration for the FCRPS. Bonneville provides electric power, transmission and energy efficiency throughout the Pacific Northwest. Created in 1937 to market and transmit the power produced by the Bonneville Dam on the Columbia River, Congress has since directed Bonneville to sell at wholesale the electrical power produced from 31 operating Federal hydro projects and to acquire non-Federal power and conservation resources sufficient to meet the needs of Bonneville's customer utilities. Bonneville also owns and operates over 15,000 miles of high-voltage transmission lines, transmitting power from the dams and other sources on an open-access non-discriminatory basis. Bonneville serves a 300,000 square mile area including Oregon, Washington, Idaho, Western Montana, and parts of Northern California, Nevada, Utah, and Wyoming.

The Bonneville Project Act of 1937 provided the statutory foundation for Bonneville's utility responsibilities and authorities. In 1974, passage of the Transmission System Act placed Bonneville under provisions of the Government Corporation Control Act (31 U.S.C. 9101-9110). The legislation provided Bonneville with "self-financing" authority and established the Bonneville Fund, a permanent, indefinite appropriation, allowing Bonneville to use its revenues from electric power and transmission ratepayers to directly fund all programs and to sell bonds to the Treasury to finance the region's high-voltage electric transmission system requirements.

In 1980, enactment of the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act) expanded Bonneville's utility obligations and responsibilities to: encourage electric energy conservation; develop renewable energy resources; and protect, mitigate and enhance the fish and wildlife of the Columbia River and its tributaries. In support of these responsibilities, Bonneville's Treasury borrowing authority was expanded to allow the sale of bonds to finance conservation and other resources and to carry out fish and wildlife capital improvements.

By 2002, BPA had a cumulative authority to have $3.75 billion in bonds outstanding to the Treasury. Bonneville received an additional $700 million in available Treasury financing through the Consolidated Appropriations Act, 2003 (Pub. L. 108-7, title VII, Section 701; 117 Stat. 551, 2003) to help assure a sufficient level of infrastructure planning. The FY 2003 Appropriations Act increased to $4.45 billion the aggregate amount of bonds Bonneville was authorized by statute to sell to the Treasury and have outstanding at any one time. The ARRA increased the amount of borrowing that BPA conducts under the Transmission System Act by $3.25 billion to the current authority for $7.70 billion in bonds outstanding to the Treasury.

Bonneville's program is treated as mandatory and nondiscretionary. As such, Bonneville is "self-financed" by the ratepayers of the Pacific Northwest and is not annually appropriated by Congress. Under the Transmission System Act, Bonneville funds the expense portion of its budget and repays the Federal investment with revenues from electric power and transmission rates. Bonneville's revenues fluctuate primarily in response to market prices for fuels and stream flow variations in the Columbia River System due to weather conditions and fish recovery needs. Through FY 2009, Bonneville has returned approximately $25.6 billion to the Treasury for payment of FCRPS O&M and other costs (about $3.1 billion), interest (about $13.0 billion), and amortization (about $9.5 billion) of appropriations and bonds.

In this FY 2011 budget, the term BPA "bonds" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13(a) of the Transmission Act (PL Law 93-454), which defines BPA bonds as all bonds, notes, and other evidences of indebtednesses issued and sold to the Treasury.

Bonneville and Treasury completed negotiations in April 2008 on an agreement to establish a new, more formal and detailed banking arrangement that meets key aims of each agency. The arrangement also modernized and formalized the BPA-Treasury relationship, and aligned practices with current Treasury standards.

The comprehensive arrangement covers BPA's short- and long-term Federal borrowings and establishes a phased-in approach to a market-based investing program. The arrangement is laid out in two primary agreements: 1) an Obligation Purchase Memorandum of Understanding and 2) an Interest Offset Credit Memorandum of Understanding. The Obligation Purchase MOU streamlines and adds flexibility for BPA's federal borrowings and provides BPA the ability to borrow for Northwest Power Act-related operating expenses. This ability provides BPA with much needed liquidity to help manage within year cash flow needs and mitigate risk. Access to this use of borrowing authority has been incorporated into and relied upon in BPA's rate-setting process.

The Interest Offset Credit MOU provides for the phase out of the interest offset methodology over a 10-year period and establishes the procedures for the phase in of market-based investing of deposits in the BPA Fund.

The Northwest Power Act also required regional energy plans and programs and created the Pacific Northwest Electric Power and Conservation Planning Council, now commonly called the Northwest Power and Conservation Council.

Treasury Payments and Budget Overview:

Bonneville made its full planned FY 2009 payment of $845 million to the Treasury, including $234 million in advanced amortization (as part of BPA's debt optimization program). Total 4(h)(10)(C) credits applied to the FY 2009 Treasury payment for fish mitigation were about $91 million. For FY 2010, Bonneville plans to pay the Treasury $834 million: $460 million to repay investment principal, $343 million for interest, and $31 million for Associated Project costs and pension and post-retirement benefits. The FY 2011 Treasury payment is currently estimated at $785 million. The FYs 2010 & 2011 4(h)(10)(C) credits, associated with fish recovery and to be applied toward BPA's Treasury payment, are estimated at $95 million and $102 million, respectively.

Estimates of interest and amortization levels for outyear Treasury payments are based on estimates from the 2010 final transmission and power rate case proposals. Bond and Appropriations Interest will continue to be revised based on upcoming capital investments and debt management actions. These estimates may change due to revised capital investment plans and actual Treasury borrowing. In recent years, BPA has made amortization payments in excess of those scheduled in its FERC-approved rate filings resulting in a balance of advance repayment. The cumulative amount of advance amortization payments as of the end of FY 2009 is about $2,536 million. Amortization estimates in this FY 2011 budget include planned amortization in advance of scheduled amortization (due to earlier EN refinancing) in FYs 2010 and 2011 of $38 million and $70 million, respectively, consistent with rate case documentation.

Starting in FY 1997, Bonneville began direct funding the Reclamation's Pacific Northwest power O&M costs, and in FY 1999 Bonneville began direct funding the Corps' Pacific Northwest power O&M costs. Bonneville began direct funding the U.S. Fish and Wildlife Service (USFWS) in FY 2001 to pay for O&M costs of the Lower Snake River Compensation Plan facilities. Bonneville's direct funding arrangement includes a portion of power O&M and capital investments. Direct funded capital costs, previously funded through appropriations, are now being paid through BPA borrowing from the Treasury. BPA's total O&M direct funding, including the small capital program, was $261 million in FY 2009.

This FY 2011 budget proposes Bonneville accrued expenditures of $3,219 million for operating expenses, $77 million for Projects Funded in Advance, $759 million for capital investments, and $387 million for capital transfers in FY 2011. The budget has been prepared on the basis of Bonneville's major areas of activity, power and transmission. This reporting structure arose as a response to FERC Orders requiring BPA to employ separate repayment studies for its generation and transmission functions to determine the repayment requirements for each.

The estimated spending levels in this budget are still subject to change to accommodate competitive dynamics in the region's energy markets, debt optimization strategies, and the continued restructuring of the electric industry.

Current Financial Status

- BPA is striving to enhance its competitive, cost-effective delivery of utility products and services and continued delivery of the public benefits of its operations, while ensuring its ability to make its payments to the Treasury on time and in full. BPA utilizes a strategic planning process using the balanced scorecard model to align all business units around specific goals and align resources to achieve these goals. From these efforts, results include continued efficiency gains, performance integration improvements, and a high assurance for repayment of Treasury borrowing.

- After many years of sustained effort, BPA has recovered from the financial effects of the 2000-2001 west coast power crisis. Continued cost management efforts have helped BPA regain adequate reserve levels despite mostly below-average water years. These gains are helping BPA continue its efforts to assure full recovery of its costs and to assure long-term financial stability while meeting its overall responsibilities to the Pacific Northwest and the U.S. taxpayer. In 2009, BPA experienced low water conditions and the effects of the downturn in the economy. BPA did not achieve its modified net revenue target for the year, but the financial reserves BPA has established resulted in still making the annual scheduled Treasury repayment in full.

- BPA aligned its transmission and power rate cases for the FY 2010-2011 rate period and consolidated its public processes on agency-wide expenses and capital plans as part of its efforts to increase transparency for customers and stakeholders. The new public process, the Integrated Program Review (IPR), was established in 2008. Costs estimated in the initial 2008 IPR process provided the basis for the final Supplemental Proposal for FY 2009 power rates, which received final approval from the FERC on July 16, 2009.

- In spring 2009, BPA initiated a second IPR to provide regional stakeholders an opportunity to revisit proposed program spending estimates for FY 2010-2011. The second IPR process assumed added significance due to the severe economic downturn as well as the FY 2009 deterioration of BPA's financial condition. Costs estimated in the second IPR provided the basis for the final proposed power and transmission rates for FYs 2010 and 2011. In July 2009, BPA issued its final Record of Decision (ROD) and submitted final proposed rates to the FERC. The FERC granted interim approval to be effective October 1, 2009. The final ROD set an average power rate increase of 7 percent, down from the initial proposal of 9.4 percent. There was no increase for any transmission rate and two required ancillary services. The Wind Balancing Service rate was increased and expanded to include imbalance.

- Bonneville released its Long-Term Regional Dialogue Policy and Record of Decision (Regional Dialogue Policy) in July 2007. The Regional Dialogue Policy is focused on defining how Bonneville will market its wholesale power after FY 2011 and to ensure it does so in a way that meets key regional and national energy goals and ensures BPA's ability to meet its Treasury obligations. BPA is working with customers now to prepare to implement the policy in 2012.

- Bonneville and 135 of its Northwest utility customers signed new power sales contracts in 2008 under which power deliveries will begin in October 2011. BPA is currently preparing a Resource Program to identify any gaps in its power supply and suggest types and amounts of resources to fill those gaps, as guided by the Council's Northwest Power Plan.

- In the Regional Dialogue Policy, BPA committed to updating its Financial Plan given the significant business and regulatory changes in the last decade. The Financial Plan, released in July 2008, addresses financial risk metrics, access to capital, variation in annual financial performance, and cost recovery. In addition, the Financial Plan describes how BPA will continue to manage to ensure that it meets its Treasury repayment responsibilities. The new plan is intended to guide the development of new financial policies and practices as they are needed.

Infrastructure Investment:

- Bonneville is planning infrastructure investments in the Pacific Northwest to meet Northwest transmission needs that will also continue to support a competitive wholesale market in the Western Interconnection that encompasses 14 western States, two Canadian provinces and one Mexican State. Construction of the 79 mile McNary-John Day line and three additional proposed transmission lines would add more than 225 miles of lines to the Northwest transmission grid, improving reliability and allowing BPA to provide service to about 3,360 MWs of requests for BPA transmission, including service for 2,575 MWs of additional green energy.

- These efforts will help meet the increasing demand for our service to meet regional greenhouse gas reduction and environmental goals. In support of these goals and as part of the Regional Dialogue implementation, BPA is working with stakeholders to determine its role in the development and use of energy efficiency for the post-2011 period. BPA is continuing to target transmission investments in those areas with reliability needs. BPA completed the first Network Open Season (NOS) in 2009 and is conducting a second NOS process, expected to be completed in May 2010. The NOS process is designed to ensure the region will have sufficient transmission infrastructure available for customers seeking capacity on BPA's transmission system network. Many of the customer capacity requests have been for delivery of wind-generated electricity.

- Bonneville has identified a number of actions that it is taking or could take over the next several years to provide additional electric system infrastructure relief. These actions include Federal hydro generation efficiencies and additions, additional renewable resource generation and conservation efforts, long-term and short-term power purchases, and construction of transmission projects that reinforce the grid and integrate new generation.

- Bonneville considers other strategies to sustain funding for its infrastructure investment requirements as well. These additional strategies include restructuring of EN debt, reserve financing of some amount of transmission investments, and seeking, when feasible, third party financing sources. See the BP-5 Potential Third Party Financing Transparency table in the budget schedules section of this budget. This FY 2011 budget assumes $15 million of annual reserve financing in FYs 2010-2015 for transmission infrastructure capital that is included in this budget in Projects Funded In Advance.

- As part of its continuing efforts, Bonneville is working to further optimize debt service costs (often referred to as debt optimization elsewhere in this budget). BPA, in collaboration with EN, may pursue the refinancing of certain EN bonds as part of an ongoing debt optimization program. Through this program, BPA uses the reductions in debt service for its EN bonds to make advance payments on its Federal debt. Implementation of the refinancing components will be subject to favorable market conditions and interest rate environment.

Budget Estimates and Planning:

- This FY 2011 budget includes capital and expense estimates based on the second IPR forecasted data and is consistent with the 2010 final transmission and power rate proposals. FY 2009 costs are based on BPA's FY 2009 audited actual financial results.

- Capital funding levels also reflect BPA's capital asset management process and external factors such as the significant changes affecting the West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region and national energy security goals. Capital investment levels in this FY 2011 budget also reflect executive management decisions from BPA's Capital Allocation Board (CAB).

- The FYs 2010-2015 revenue estimates in this budget, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools; for example, upcoming rate adjustment mechanisms, reduced cost estimates, a net revenue risk adjustment, debt management strategies, and/or short-term financial tools to manage net revenues and cash.

- Revenue calculations include depreciation and 4(h)(10)(C) credit assumptions. These credits offset BPA's fish and wildlife program costs allocable to the non-power project purposes of the FCRPS, consistent with the Northwest Power Act. Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses.

- Bonneville's efforts to keep its rates as low as possible are augmented by the implementation of the BPA Appropriations Refinancing Act (part of the Omnibus Consolidated Rescissions and Appropriations Act of 1996) that refinanced Bonneville's outstanding repayment obligations on appropriations. The legislation called for raising low interest rates on historic appropriations to then current Treasury market rates and resetting the principal of unpaid FCRPS appropriations. As called for in the legislation, Bonneville submitted its calculations and interest rate assignments implementing the refinancing to the Treasury. The Treasury then approved the BPA submission in July 1997, thus finalizing the implementation of the BPA Appropriations Refinancing Act refinancings.

- The Residential Exchange Program (REP) was created by the Northwest Power Act to extend the benefits of low-cost Federal power to the residential and small farm customers of Pacific Northwest electric utilities that meet certain conditions. In 2000, BPA and the region's six Investor Owned Utilities (IOUs) signed agreements that settled the REP and discontinued implementation of a traditional REP. In May 2007, the U.S. Court of Appeals for the Ninth Circuit held that the REP Settlement Agreements reached with IOUs were not consistent with the Northwest Power Act. The WP-07 Supplemental rate case was conducted in 2008 to respond to the Court's rulings and revise power rates for FY 2009. The 2007 Supplemental Wholesale Power Rate Case Administrator's Final Record of Decision (WP-07 Supplemental ROD), studies and documentation for the WP-07

Supplemental rate case determined the amount by which the Preference customers were overcharged in FYs 2002-2006 as a result of the REP Settlement Agreements, the PF and PF Exchange rates for FY 2009, as well as the magnitude of the initial amount to be returned to the Preference customers in FY 2009 for overcharges during FYs 2002-2006. See the BPA/Power Services- Operating Expense section of this FY 2011 budget for a more complete discussion of REP.

- The Energy Policy Act of 2005 authorized FERC to approve and enforce mandatory electric reliability standards with which users, owners and operators of the bulk power system, including traditionally non-jurisdictional entities, are required to comply. These standards became enforceable on June 18, 2007, and compliance is monitored by the NERC and the regional reliability organizations. The Department of Energy, however, is currently reviewing whether financial penalties may be imposed on federal agencies for violations of electric reliability standards.

- As part of its strategic staffing efforts and implementation of operational efficiency initiatives, Bonneville decreased its Full-Time Employee (FTE) level. More recently Bonneville has taken on added mission related responsibilities, including its increasing wind integration efforts. BPA expects FTE to level out at about 3,100 FTE for the next few years. BPA continues to consider various authorities, including the use of Voluntary Separation Incentive Payments (VSIP) and Voluntary Early Retirement Authority (VERA) to help achieve targeted levels.

Fish and Wildlife Program Overview:

- Bonneville is committed to continue funding its share of the region's efforts to recover listed Columbia Basin fish and wildlife. To the extent possible, Bonneville is integrating the actions implemented in response to the FCRPS Biological Opinions (BiOps) [including the National Oceanic and Atmospheric Administration (NOAA) Willamette River BiOp and the United States Fish and Wildlife Service's (USFWS) 2006 Libby Dam BiOp] with projects implemented under the Council's Fish and Wildlife Program. Sub-basin plans that include prioritized strategies for mitigation actions will help guide project selection to meet both BPA's ESA and Northwest Power Act responsibilities.

- Bonneville's Fish and Wildlife program provides for extensive protection, mitigation, and enhancement of Columbia River Basin fish and wildlife adversely affected by the development and operation of Federal hydroelectric projects on the Columbia River and its tributaries from which Bonneville markets power. Bonneville satisfies a major portion of its fish and wildlife responsibilities by funding projects and activities consistent with the Council's Fish and Wildlife Program (Program) developed pursuant to Section 4(h) of the Northwest Power Act. Through the Program BPA also implements measures addressed to the recovery of fish in the Columbia River and its tributaries, listed as threatened or endangered under the ESA. Bonneville pursues a comprehensive approach to integrate the ESA requirements of the FCRPS BiOps with the broad resource protection, mitigation and enhancement objectives of the Program.

- BPA, the Corps and Reclamation signed historic 10-year agreements, known as the Columbia Basin Fish Accords, with five Columbia Basin Indian tribes and two states in 2008. In 2009, Agreements were signed with another tribe, state, and federal agencies. These agreements provide specific hydro, habitat, hatchery and other measures that will address recovery needs and provide measurable biological benefits for fish. The agreements set a course of action for restoration of salmon and steelhead listed for protection under the ESA and other important non-listed populations.

- Included with the budget schedules section of this budget document is the current tabulation of Bonneville's fish and wildlife costs from FY 2000 through 2009.

Overview of Detailed Justifications:

Bonneville's Detailed Justification Summaries, included in this FY 2011 budget, follow present budget requirements for budget line items on the basis of accrued expenditures. Accrued expenditure is the basis of presenting Bonneville's program funding levels in the power and transmission rate making processes and the basis upon which Bonneville managers control their resources to provide products and services. Accrued expenditures relate period costs to period performance. Traditional budget obligation requirements for Bonneville's budget are assumed on the Program and Financing Summary Schedule prepared in accordance with OMB Circular A-11.

The organization of BPA's FY 2011 budget and these performance summaries reflect Bonneville's business services basis for utility enterprise activities. Bonneville's major areas of activity on a consolidated budget and accounting basis include power and transmission with administrative costs included. PS includes line items for Fish and Wildlife, Conservation and Energy Efficiency, REP, Associated Projects O&M Costs, and the Council. Environmental activities are shown in the relevant PS and TS sections, as are reimbursable costs. Bonneville's interest expenses, pension and post-retirement benefits and capital transfers to the Treasury are shown by program.

The first section of performance summaries, Capital Investments, includes accrued expenditures for investments in electric utility and general plant associated with the FCRPS generation and transmission services, conservation and energy efficiency services, fish and wildlife, and capital equipment. These capital investments will require budget obligations and use of borrowing authority of $759 million in FY 2011.

The near-term forecast capital funding levels have undergone an extensive internal review as a result of the capital asset management strategy. These capital reviews encompass project cost management initiatives, capital investment assessments, and categorization of capital projects to be funded based on risk and other factors. Consistent with BPA's near-term capital funding review process and BPA's standard operating budget process, this FY 2011 budget includes updated capital funding levels for FY 2010. Utilizing this review process helps Bonneville in its efforts to compete in the deregulated wholesale energy market. Bonneville will continue to work with the Corps and Reclamation to optimize the best mix of projects.

In addition to its extensive internal management assessment of capital investments, Bonneville has developed and implemented an associated external capital investment review process that provides significant benefits to Bonneville. The combined internal and external processes add value by both improving direction on what the FCRPS invests in (tying investments more closely to agency strategy) and by improving how those investments are made (better analysis and review of capital investments and their alternatives).

Bonneville's second section of the performance summaries, entitled Annual Operating Expenses, includes accrued expenditures for services and program activities financed by power sales revenues, transmission services revenues and projects funded in advance. For FY 2011, budget expense obligations are estimated at $3,219 million. The total program requirements of all Bonneville programs include estimated budget obligations of $4,054 million in FY 2011.

Bonneville Power Administration

Funding Profile by Subprogram 1/

(accrued expenditures in thousands of dollars)

	Fiscal Year				
	2009 Audited Actuals	2010 Original [/2]	2010 Adjustments	2010 Revised [/2]	2011 Proposed
Capital Investment Obligations					
Associated Project Costs [3/]	139,552	N/A	-	158,884	172,477
Fish & Wildlife	27,795	N/A	-	70,000	60,000
Conservation & Energy Efficiency [3/]	17,988	N/A	-	33,495	40,331
Subtotal, Power Services [4/]	185,335	N/A	-	262,379	272,808
Transmission Services	192,731			450,498	462,213
Capital Equipment & Bond Premium	31,092	N/A	-	23,723	23,889
Total, Capital Obligations [3/] [5/]	409,158	845,566	-	736,600	758,910
Expensed and Other Obligations					
Expensed	2,410,146	3,029,504	-	2,983,698	3,219,446
Projects Funded in Advance	184,000	105,164	-	77,403	77,179
Total, Obligations	3,003,304	3,980,234		3,797,701	4,055,535
Capital Transfers (cash) [5/]	432,019	419,996	-	459,829	386,870
BPA Total	3,435,323	4,400,230	-	4,257,530	4,442,405
Full-time Equivalents (FTEs)	3,021	3,061	-	3,100	3,100

Public Law Authorizations include:

Bonneville Project Act of 1937, Public Law No. 75-329, H.R. 7642

Federal Columbia River Transmission Act of 1974, Public Law No. 93-454 S. 3362

Regional Preference Act of 1964, Public Law No. 88-552

Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act), Public Law No. 96-501, S. 885

Outyear Funding Profile by Subprogram 1/

(accrued expenditures in thousands of dollars)

	Fiscal Year			
	2012	2013	2014	2015
Capital Investment Obligations				
Associated Project Costs 3/	180,371	190,603	192,327	196,180
Fish & Wildlife	50,000	50,000	50,000	50,000
Conservation & Energy Efficiency 3/	48,099	48,080	48,082	48,086
Subtotal, Power Services 4/	278,470	288,683	290,409	294,266
Transmission Services	526,854	437,557	394,952	428,746
Capital Equipment & Bond Premium	28,782	28,923	29,297	29,884
Total, Capital Obligations 3/ 5/	834,106	755,163	714,658	752,896
Expensed and Other Obligations				
Expensed	3,343,947	3,531,188	3,614,487	3,683,485
Projects Funded in Advance	78,060	78,099	78,137	59,231
Total, Obligations	4,256,113	4,364,450	4,407,282	4,495,612
Capital Transfers (cash) 5/	332,261	197,364	150,700	90,958
BPA Total	4,588,374	4,561,814	4,557,982	4,586,570
Full-time Equivalents (FTEs)	3,100	3,100	3,100	3,100

The accompanying notes are an integral part of this table.

1/ This budget has been prepared in accordance with the Budget Enforcement Act (BEA) of 1990. Under this Act all BPA budget estimates are treated as mandatory and are not subject to the discretionary caps included in the BEA. These estimates support activities which are legally separate from discretionary activities and accounts. Thus, any changes to BPA estimates cannot be used to affect any other budget categories which have their own legal dollar caps. Because BPA operates within existing legislative authority, BPA is not subject to a Budget Enforcement "pay-as-you-go" test regarding its revision of current-law funding estimates.

2/ Original estimates reflect BPA's FY 2010 Congressional Budget Submission. Revised estimates, consistent with BPA's annual near-term funding review process, provide notification to the Administration and Congress of updated capital and expense funding levels for FY 2010.

3/ Includes infrastructure investments designed to address the long-term needs of the Northwest, to reflect significant changes affecting BPA's power and transmission markets, and to reflect project implementation schedules. Actual expenditures may vary.

4/ Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

5/ This FY 2011 budget includes capital and expense estimates based on IPR 2 forecasted data for FYs 2010-2015 and consistent with estimates from the 2010 final transmission and power rate cases.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

The cumulative amount of actual advance amortization payments as of the end of FY 2009 is $2,536 million.

Refer to 16 USC Chapters 12B, 12G, 12H, and BPA's other organic laws, including P.L. 100-371, Title III, Sec. 300, 102 Stat. 869, July 18, 1988 regarding BPA's ability to obligate funds.

Major Outyear Considerations

Bonneville's outyear estimates reflect its ongoing efforts to achieve its long-term mission and strategic direction. The outyear estimates are developed with consideration of and support of BPA's multi-year performance targets that lay out the course for achieving BPA's long-term objectives. Outyear capital investment levels support BPA's infrastructure program, hydro efficiency program, conservation and energy efficiency projects, and its fish and wildlife mitigation projects.

With passage of the Energy Policy Act of 2005, Bonneville continues to incorporate the various aspects of the legislation related to its business, in particular the energy supply, conservation and new energy technologies for the future that are highlighted in the legislation.

Power Services - Capital

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Power Services - Capital	FY 2009	FY 2010	FY 2011
Associated Project Costs	139,552	158,884	172,477
Fish & Wildlife	27,795	70,000	60,000
Conservation & Energy Efficiency	17,988	33,495	40,331
Total, Power Services - Capital	185,335	262,379	272,808

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Power Services - Capital	278,470	288,682	290,409	294,266

Description

Associated Project Costs provide for direct funding of additions, improvements and replacements of existing Reclamation and Corps hydroelectric projects in the Pacific Northwest that provide for increased performance and availability of generating units. The Reclamation and Corps hydro projects produce electric power that is marketed by Bonneville.

Maintaining the availability and increasing the efficiency of the FCRPS is critical to ensuring that the region has an adequate, reliable and low-cost power system. The FCRPS represents about 80 percent of Bonneville's firm power supply and is comprised of 31 operating Federal hydro electric projects with over 200 generating units. These projects have an average age of about 50 years, with some that exceed 60 years of age. Through direct funding and the close cooperation of the Corps and Reclamation, Bonneville uses its Treasury borrowing authority to make investments needed to restore generation availability and improve efficiency, reducing demand on Corps and Reclamation appropriations for power-related investments. Since the beginning of direct funding, Bonneville, along with these joint operating partners has improved system performance. In 1999, at the direction of Congress, Bonneville issued a report that it soon began to implement called the "Asset Management Strategy for the FCRPS." Bonneville concluded in this report that it needed to invest nearly $1 billion in the projects over the next 12-15 years. Without these investments, which are focused on restoring and maintaining the reliability of the system, history indicates that unit availability may initially decline at a rate of about 1.5 percent per year. Supplementary analyses and experience with the system have revealed additional investment needs above and beyond the levels originally planned under the Asset Management Strategy for this and the next several rate periods. In late 2008, BPA completed a System Asset Plan that effectively updated the 1999 Asset Management Strategy and refined the long-term capital investment needs to preserve the performance of the system.

These planned investments, included in the FY 2011 budget funding estimates, will maintain the generation performance of the FCRPS. Moving forward with the cost-effective opportunities to expand the generation and to preserve and enhance the capability of the Federal system is a smart economic and environmental decision when compared to purchasing power from the market to serve growing Pacific Northwest electricity needs.

Fish and Wildlife Program costs provide funding to implement measures to aid in the recovery of fish in the Columbia River and its tributaries that are listed as threatened or endangered under the ESA and the protection, mitigation, and enhancement, of fish and wildlife impacted by the development and operation of the FCRPS, from which Bonneville markets power.

Bonneville continues a comprehensive approach to integrate the ESA requirements of the FCRPS Biological Opinions with the broad resource protection, mitigation and enhancement objectives of the Columbia River Basin Fish and Wildlife Program (Program), adopted by the Council pursuant to the Northwest Power Act. Bonneville satisfies a major portion of its fish and wildlife responsibilities by funding projects and activities that implement the Program. Bonneville also implements measures addressed to avoid jeopardizing listed salmon and steelhead as required under the ESA.

The ESA measures are part of the most recent BiOps issued by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA) and the USFWS. In February 2006, USFWS issued a new BiOp for Libby Dam for the Kootenai River white sturgeon and bulltrout. In May 2008, NOAA issued the new, remanded FCRPS BiOp, which is again being challenged in Oregon District Court by the same plaintiffs. Also, as described below, in July 2008, USFWS and NOAA issued Willamette River BiOps for the first time, to address impacts from 13 federal dams located throughout the Willamette Basin. These BiOps, and the 2000 USFWS FCRPS BiOp covering bull trout, collectively, require the action agencies (Corps, Bureau, and BPA) to implement actions throughout the Columbia River Basin to address impacts stemming from the operation of the Federally operated hydro-dams on ESA-listed fish, and to ensure that operations of the federal dams do not jeopardize the continued existence of the listed species or adversely modify their designated critical habitat.

The 2004 FCRPS BiOp was challenged in Federal District Court. During the remand period, the Court ordered the applicable tribes and state governments to collaborate to try to develop a Biological Opinion that would have broad regional support. The collaboration process resulted in the NOAA Fisheries' May 2008 FCRPS BiOp.

An additional result from the remand collaboration was the 2008 Columbia Basin Fish Accords (Fish Accords) that the FCRPS action agencies signed with five Northwest Tribes, and the states of Idaho and Montana. In 2009, additional agreements were signed with another tribe, federal agencies, and the State of Washington. The Fish Accords supplement the activities encompassed within the 2008 BiOp and the Council's Program, by providing firm commitments to mitigation actions and to secure funding for the next 10 years. As a result of the new BiOp and the Accords, as discussed below, expenditures above and beyond those planned in FY 2009 are required for FY 2010 and FY 2011.

There has also been litigation directed at the USFWS Biological Opinions for Libby Dam. In 2003, the Corps and BPA reinitiated consultation for the operations at Libby Dam to address impacts to recently designated critical habitat for the Kootenai River white sturgeon, and to evaluate information that had been developed on Kootenai River white sturgeon and bull trout since the 2000 USFWS BiOp. That consultation was completed in February 2006 but was challenged by environmental groups, the Kootenai Tribe, and the State of Montana in Federal District Court in Montana. That litigation was settled in March 2009.

The NOAA 2008 Willamette BiOp was issued on July 11, 2008. In this BiOp NOAA Fisheries issued a Jeopardy Opinion with Reasonable and Prudent Alternatives (RPAs) that describe potential river operations and configuration changes, improvements to hatcheries, flow changes, and habitat actions designed to address Willamette Project impacts to the Upper Willamette River spring chinook and the Upper Willamette River steelhead, both listed as threatened under ESA in 1999. The USFWS also issued a BiOp for the Willamette Projects on July 11, 2008, that addresses Project impacts on bull trout and the Oregon chub. The Oregon chub was listed as endangered in 1993. The bull trout was listed as threatened in 1998.

These BiOps and Fish Accord commitments, and other projects undertaken to implement the Columbia Basin Fish and Wildlife Program pursuant to the Northwest Power Act, are the basis for BPA Environment, Fish and Wildlife division's planned capital investment.

Bonneville's fish and wildlife capital program is directed at activities that increase numbers of Columbia River Basin fish and wildlife resources, including projects designed to increase juvenile and adult fish passage in tributaries and at mainstream dams and to increase fish production and survival through construction of hatchery and acclimation facilities, land acquisitions for resident fish and wildlife that are consistent with Bonneville's Capital Policy, and fish monitoring facilities. Capital project funding will focus on integrating ESA-related priorities with the region's Columbia Basin Fish and Wildlife Program in order to efficiently meet the regional costs of both salmon and steelhead recovery and the mitigation of hydrosystem impacts to other Columbia Basin fish and wildlife.

The FY 1996 Energy and Water Appropriations Act added section 4(h)(10)(D) to the Northwest Power Act, directing the Council to appoint an Independent Scientific Review Panel (ISRP) "to review a sufficient number of projects" proposed to be funded through Bonneville's fish and wildlife budget "to adequately ensure that the list of prioritized projects recommended is consistent with the Council's program." The Northwest Power Act further states that "... in making its recommendations to Bonneville, the Planning Council shall consider the impact of ocean conditions on fish and wildlife populations; and shall determine whether the projects employ cost effective measures to achieve program objectives." Today, most mitigation projects funded by Bonneville receive ISRP review as part of the Council recommendation process. The Council has shifted to a multi-year project review cycle during which the ISRP will review categories of projects grouped together; e.g., all terrestrial wildlife projects were recently reviewed. The Council plans to complete this cycle in 2011.

Under the Northwest Power Act, the Council must develop a Fish and Wildlife Program that protects, mitigates and enhances Columbia River Basin fish and wildlife affected by any hydroelectric project in the basin. To the extent possible, Bonneville is integrating the actions implemented in response to the FCRPS BiOps with projects implemented under the Columbia Basin Fish and Wildlife Program. Sub-basin plans that include prioritized strategies for mitigation actions will help guide project selection that meets both BPA's ESA and Northwest Power Act responsibilities. In order to address the *in lieu* provision of the Northwest Power Act, which prohibits BPA from funding mitigation that other entities are authorized or required to undertake, BPA continues its ongoing work with the Council and the regional fish and wildlife managers, customers, and tribes to review projects to ensure ratepayers fund appropriate mitigation.

Conservation is an important part of Bonneville's diverse portfolio of resources that provides a reliable approach to meeting Bonneville's load obligations. When acquiring resources to meet planned future loads, the Northwest Power Act requires the Administrator to first consider and acquire cost-effective conservation that the Administrator determines is consistent with the Northwest Power and Conservation Council's Power Plan. The Council's most recent Power Plan, finalized in January 2005, recommended that the region target 700 aMW of conservation in 2005 to 2009. These conservation targets increased as a result of the Council's 6th Power Plan which was issued September 3, 2010. Bonneville's share of the conservation target from the 5th Power Plan is 40 percent or 280 aMW. Bonneville anticipates that between 100 and 150 aMW of this amount will be acquired under its capital conservation acquisition program. Program performance measurements ($/aMW) indicate that Bonneville is realizing excellent value for these investments as benchmarked against other utilities across the nation.

Long-term investments in energy efficiency help buffer the FCRPS against future resource uncertainties. During periods of price volatility, conservation also helps reduce financial risk associated with relying on the market for energy purchases in the future. The demand for more energy efficiency is driven by potential climate change initiatives, the high cost of new generation, and citizens and businesses wanting to reduce costs and be green.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Associated Project Costs	**139,552**	**158,884**	**172,477**

BPA will work with both the Corps and Reclamation to reach mutual agreement on those capital improvement projects that need to be budgeted and scheduled, are cost-effective and provide system or site-specific enhancements, increase system reliability, or provide generation efficiencies.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

The work is focused on improving the reliability of the FCRPS, increasing its generation efficiency or capacity through turbine runner replacements, optimization of hydro facility operation and new unit construction, and small capital reimbursements associated with routine maintenance activities. Also, limited investments may be made in joint use facilities that are beneficial to both the FCRPS operations and to other Corps and Reclamation project purposes.

- **Corps of Engineers (known projects to date)**

FY 2009: For overall general system, continued hydro optimization investigations and equipment installations at selected projects through the power plant efficiency improvements project. Completed Intercontrol Center Communications Protocol (ICCP) improvements at multiple projects.

For Bonneville, continued exciter installation, DC and preferred AC upgrades, station service upgrades, headgate refurbishment/replacements, gantry crane replacement, unwatering pump replacement, HVAC upgrade, fire protection upgrades, additional crane and deck refurbishments, and began elevator replacements. For Bonneville Powerhouse 1, continued rehabilitation work which is nearly completed. For John Day, continued exciter replacements, fire protection upgrades and bridge crane refurbishment, and began elevator rehabilitation. And, began protective relay replacements. For The Dalles, completed T-2 transformer replacement, and continued governor replacement, station service improvements, generator rewinds, a 230kV transformer replacement, fire protection design and upgrades, disconnect replacement, oil/water separator development, intake crane rehabilitation and heat pump replacement. And, began elevator upgrades.

For the Willamette plants, completed plant upgrade and refurbishing of the turbine replacement which failed during testing at Cougar, main unit breaker replacement at Dexter, and butterfly valve refurbishment at Hills Creek. Continued turbine runner replacement and bridge crane refurbishment at Hills Creek and at Lookout Point, exciter replacements at Cougar, Green Peter, Foster, and Hills Creek, fire protection upgrades for all Willamette Valley projects, remote control upgrades, generator winding replacement and electric reliability upgrades at Detroit, emergency engine installation at Detroit, and penstock roller gate repair at Lookout Point. And, began protective relay replacements at Cougar, Green Peter, Foster, Hills Creek, Lookout Point and Dexter, fire protection upgrades at Lost Creek, spillway bulkhead gates refurbishment at Big Cliff and Dexter, and stop log fabrication at Foster.

For Albeni Falls, continued governor replacement project, hi-lift pump replacement, auxiliary boards upgrades, and began DC system boards and breaker replacement, and spillway crane modernization. For Libby, continued exciter replacement, HVAC controls rehabilitation, various elevator refurbishments and selective withdrawal crane refurbishment. For Chief Joseph, continued 480-V upgrade/SQ0 substation replacement, CO2 system replacement, supervisory control console replacement, exciter replacements, protective relay replacements, automatic synchronizer replacement and turbine replacements, And, began DC and preferred AC upgrades, generator brake replacement, and generator cooling system upgrades.

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

For McNary, completed external oil cooler installation and spare bulkhead replacements. Continued governor replacements, DC and preferred AC upgrades, generator winding replacements, transformer purchases and installations and drainage pump replacement. And, began protective relay replacements and bridge and intake crane refurbishments. For Dworshak, completed fire protection upgrades, and continued bridge crane refurbishment, emergency notification upgrades and elevator upgrades.

For Lower Snake plants, completed fire protection and continued emergency notification upgrades. Individually, for Ice Harbor, continued unit 2 runner replacement and tailrace crane rehabilitation, and began T6 transformer replacement and potable water system replacement. For Little Goose, continued diesel generator replacement, and began exciter replacements and HVAC control upgrade. For Lower Granite, continued generator winding replacements, unit 2 linkage repair, diesel generator replacement and intake crane replacement, and began exciter replacements, SQ2 replacement and elevator refurbishments. For Lower Monumental, completed T-1 disconnect replacement, and continued diesel generator replacement, bridge crane refurbishment, spare draft tube bulkhead purchase and intake crane refurbishment/replacement. And, began exciter replacements, SQ2 replacement and unit 1 linkage repair.

In addition, new investments were pursued per the Asset Plan and repairs to failed units occurred as needed to restore availability.

FY 2010: For overall general system, continue hydro optimization investigations and equipment installations at selected projects through the power plant efficiency improvements project.

For Bonneville, complete exciter installation, DC and preferred AC upgrades, gantry crane replacement, unwatering pump replacement, HVAC upgrade and elevator replacement, and continue station service upgrades, headgate refurbishment/replacements, fire protection upgrades and additional crane and deck refurbishments. For John Day, complete exciter replacements and elevator rehabilitation, and continue fire protection upgrades, protective relay replacements, and bridge crane refurbishment. For The Dalles, complete the 230 kV transformer replacement, disconnect replacement, oil/water separator development, intake crane rehabilitation and heat pump replacement, and continue governor replacement, station service improvements, generator rewinds and fire protection design and upgrades.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

For the Willamette plants, complete fire protection upgrades for all projects, except Lost Creek, exciter replacements at Cougar, Green Peter, Foster, and Hills Creek, crane refurbishments at Detroit, Hills Creek and Lookout Point and spillway bulkhead gates refurbishment at Big Cliff and Dexter. Also, complete remote control upgrades, electric reliability upgrades and emergency engine installation at Detroit, and stop log fabrication at Foster. Continue protective relay replacements at Cougar, Green Peter, Foster, Hills Creek, Lookout Point and Dexter, turbine runner replacements at Hills Creek and Lookout Point, penstock roller gate repair at Lookout Point and fire protection upgrades at Lost Creek.

For Albeni Falls, complete governor replacement project, hi-lift pump replacement and spillway crane modernization, and continue auxiliary board upgrades and DC system boards and breaker replacement. For Libby, complete HVAC controls rehabilitation, various elevator refurbishments and selective withdrawal crane refurbishment, and continue exciter replacement. For Chief Joseph, complete supervisory control console replacement, and continue 480-V upgrade/SQ0 substation replacement, CO2 system replacement, exciter replacements, protective relay replacements, automatic synchronizer replacement, DC and preferred AC upgrades, generator brake replacement, generator cooling system upgrades and turbine replacements.

For McNary, complete DC and preferred AC upgrades, drainage pump replacement and bridge and intake crane refurbishments. Continue governor replacements, generator winding replacements, new transformer installations and protective relay replacements. For Dworshak, complete bridge crane refurbishment and elevator upgrades, and continue emergency notification upgrades.

For Lower Snake plants, complete emergency notification upgrades at 2 of the 4 plants. Individually, for Ice Harbor, complete potable water system replacement and tailrace crane rehabilitation, and continue unit 2 runner replacement and T6 transformer replacement. For Little Goose, complete HVAC control upgrade, and continue diesel generator replacement and exciter replacements. For Lower Granite, complete unit 2 linkage repair and elevator refurbishments, and continue generator winding replacements, diesel generator replacement, exciter replacements, SQ2 replacement and intake crane replacement. For Lower Monumental, complete spare draft tube bulkhead purchase, and continue diesel generator replacement, exciter replacements, SQ2 replacement, unit 1 linkage repair bridge crane refurbishment and intake crane refurbishment/replacement.

In addition, new investments will be pursued per the Asset Plan and repairs to failed units will occur as needed to restore availability.

FY 2011: For overall general system, continue hydro optimization investigations and equipment installations at selected projects through the power plant efficiency improvements project.

For Bonneville, complete station service upgrades and additional crane and deck refurbishments, and continue headgate refurbishment/replacements and fire protection upgrades. For John Day, continue fire protection upgrades, protective relay replacements and bridge crane refurbishment. For The Dalles, complete station service improvements and generator rewinds, and continue governor replacement and fire protection design and upgrades.

For the Willamette plants, complete fire protection upgrades at Lost Creek, and continue protective relay replacements at Cougar, Green Peter, Foster, Hills Creek, Lookout Point and Dexter, turbine runner replacements at Hills Creek and Lookout Point and penstock roller gate repair at Lookout Point.

For Albeni Falls, complete auxiliary board upgrades, and continue DC system boards and breaker replacement. For Libby, continue exciter replacement. For Chief Joseph, complete 480-V upgrade/SQ0 substation replacement, and continue CO2 system replacement, exciter replacements, protective relay replacements, automatic synchronizer replacement, DC and preferred AC upgrades, generator brake replacement, generator cooling system upgrades and turbine replacements.

For McNary, complete new transformer installations, and continue governor replacements, generator winding replacements and protective relay replacements. For Dworshak, complete emergency notification upgrades.

For Lower Snake plants, complete emergency notification upgrades an additional plant bringing the total completions to 3 of the 4 plants. Individually, for Ice Harbor, continue unit 2 runner replacement and T6 transformer replacement. For Little Goose continue diesel generator replacement and exciter replacements. For Lower Granite, complete generator winding replacements and intake crane replacement, and continue diesel generator replacement, exciter replacements and SQ2 replacement. For Lower Monumental, complete bridge crane refurbishment, and continue diesel generator replacement, exciter replacements, SQ2 replacement, unit 1 linkage repair and intake crane refurbishment/replacement.

In addition, new investments will be pursued per the Asset Plan and repairs to failed units will occur as needed to restore availability.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Bureau of Reclamation (known projects to date):

FY 2009: For Grand Coulee, completed left/right and third power plants roof replacements, 500 MV breaker replacements and 500 kV bus differential relay replacements. Continued SCADA replacement, 11.95 KV switchyard upgrade, 500-230 kV relay replacements, air housing cooler replacements, various transformer replacements, right power plant station service upgrades, third power plant exciter replacements, third power plant governor replacement, left power plant spare transformer purchases, left and right powerhouse runner replacements and hydro optimization investigations with related equipment installations. And, began third power plant high voltage cable replacement, unit 19-20 upgrades including winding replacements, purchase of another left and right powerhouse spare winding, third power plant fixed wheel gate chamber modifications, third power plant elevator rehabilitation and construction of a material storage building. For Hungry Horse, completed station service breaker replacement, and continued SCADA replacement, molded case breaker replacement and main unit breaker replacements. For Palisades, began design for turbine runner replacement. For Chandler, continued exciter replacements, and began transformer replacement. For Roza, completed transformer replacement, and continued exciter replacements. For Green Springs, continued transformer replacement. In addition, new investments will be pursued per the Asset Plan and repairs to failed units will occur as needed to restore availability.

FY 2010: For Grand Coulee, complete 11.95 KV switchyard upgrade, 500-230 kV relay replacements and third power plant fixed wheel gate chamber modifications. Continue SCADA replacement, air housing cooler replacements, various transformer replacements, right power plant station service upgrades, third power plant exciter replacements, third power plant governor replacement, left power plant spare transformer purchases, third power plant high voltage cable replacement, unit 19-20 upgrades including winding replacements, purchase of another left and right powerhouse spare winding, third power plant elevator rehabilitation, construction of a material storage building, left and right powerhouse runner replacements and hydro optimization investigations with related equipment installations. For Hungry Horse, complete molded case breaker replacements, and continue SCADA replacement and main unit breaker replacements. For Palisades, continue turbine runner replacement. For Chandler, complete exciter replacements and continue transformer replacement. For Roza, complete exciter replacements. For Green Springs, continue transformer replacement. In addition, new investments will be pursued per the Asset Plan and repairs to failed units will occur as needed to restore availability.

	(dollars in thousands) FY 2009	FY 2010	FY 2011

FY 2011: For Grand Coulee, complete K10 transformer replacement. Continue SCADA replacement, air housing cooler replacements, third power plant transformer replacements, right power plant station service upgrades, third power plant exciter replacements, third power plant governor replacement, left power plant spare transformer purchases, third power plant high voltage cable replacement, unit 19-20 upgrades including winding replacements, purchase of another left and right powerhouse spare winding, third power plant elevator rehabilitation, construction of a material storage building, left and right powerhouse runner replacements and hydro optimization investigations with related equipment installations. For Hungry Horse, complete main unit breaker replacements, and continue SCADA replacement. For Palisades, continue turbine runner replacement. For Chandler, continue transformer replacement. For Green Springs, complete transformer replacement. In addition, new investments will be pursued per the Asset Plan and repairs to failed units will occur as needed to restore availability.

	FY 2009	FY 2010	FY 2011
Fish and Wildlife	**27,795**	**70,000**	**60,000**

BPA continues to build budgets based on the suite of mitigation projects it adopted in 2007 on recommendations from the Council. BPA reaffirmed many project-specific commitments in 2008 through both Biological Opinions and Fish Accords. These decisions were based upon the management objectives and priorities in the Program and Sub-basin Plans as well as an integration of ESA responsibilities as described in the NOAA Fisheries and U.S. Fish and Wildlife Service's FCRPS Biological Opinions. Coordination continues among BPA, Council, Federal resource management agencies, states, tribes and others to plan for additional projects to fill specific gaps in BPA's mitigation portfolio through targeted solicitations.

BPA intends to continue implementation of the projects listed below for 2009 - 2011. These facilities are based upon the best available science and are regionally important in that they provide high priority mitigation and recovery actions for fish and wildlife populations as affected by the FCRPS, under the auspices of the Northwest Power Act and the Endangered Species Act. Projects and facilities listed below deliver direct on-the-ground benefits to both ESA listed and non- listed fish and wildlife throughout the Columbia River Basin and have been evaluated and coordinated with the Northwest Power and Conservation Council, state, Federal and tribal fish and wildlife resource managers, local governments, watershed and environmental groups and other interested parties.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

FY 2009-2011 efforts include continued implementation of high priority ESA-related projects and activities associated with the currently operative NOAA and USFWS BiOps and Fish Accords.

Implementation of reforms to FCRPS hatchery programs that help reduce impacts upon ESA-listed populations will be done following ESA consultations with NOAA and after information on the types of changes to these facilities are established through the BPA funded hatchery genetic management plans and priorities for sequencing implementation are developed.

Although not subject to the Northwest Power Act's section 4(h)(10)(B) for capital construction projects, Bonneville may include capitalization of investment in some fish and wildlife habitat acquisitions provided the land acquisition costs exceed $1 million, such investment provides a creditable and quantifiable benefit against a defined obligation for Bonneville, and is consistent with Bonneville's Capitalization Policy.

The five types of capital projects as defined by the FY 2009 Power Rate Case are as follows:

1) Tributary passage -- Activities that enhance fish passage to tributary rivers. For the purpose of this policy, a tributary is defined by the Council designated sub-basin of the tributary. Functionally interdependent work elements could contain the following: wells, ladders, screens, pumping, culverts, diversion (irrigation) consolidation, piping to reduce water loss, irrigation efficiencies (drip irrigation), lining of ditches (seepage reduction), removal of damming objects or pushup dams in conjunction with related construction, and construction related habitat restoration.
2) Gas abatement -- Projects that reduce or eliminate the super-saturation of gaseous nitrogen in water beneath the dam spillways.
3) Hatchery facility construction -- Projects and activities relating to the construction of fish hatcheries, including related satellite facilities (acclimation ponds). This may also include construction-related habitat restoration.
4) Mainstem passage -- Projects and activities which benefit fish passage in the mainstem of Columbia River or Snake River. Capital projects include: ladders, removable spillway weirs, collection facilities, PIT tag facilities, etc.
5) Land acquisition -- Land acquisition projects protect, enhance, and maintain instream wetland and riparian habitat and provide habitat units (HUs) for wildlife and instream miles for resident fish to fulfill the legal obligation of FCRPS.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

Anadromous fish supplementation, production and related facilities, and/or juvenile and adult passage improvement projects that may require capital funds in FY 2011 include the following:

- Okanogan Basin Locally Adapted Steelhead Supplementation Program: This project will expand Cassimer Bar Hatchery to meet the estimated production level of 200,000 summer steelhead smolts to supplement natural production within the Okanogan River Basin. The goal is to increase abundance and accelerate recovery of endangered steelhead in the Basin. The Colville Tribes will operate the hatchery program using locally-adapted broodstock collected at weirs. The project will require development, review and approval of a Master Plan and completion of the other steps of the Council's 3-Step Review Process.

- Leaburg Dam Fish Sorter: This project is located on the Willamette River and will allow managers to efficiently separate natural origin Upper Willamette Spring Chinook (UWSC) from hatchery reared Chinook. The UWSC are listed as an endangered species under the Endangered Species Act. The Willamette Biological Opinion identifies the need to exclude hatchery reared salmon from entering habitat that is being reserved only for natural origin (wild) salmon. This project will ensure that only UWSC fish pass the dam and move into some of the most highly productive salmon habitat available in the Willamette River.

- Crystal Springs Hatchery Facilities: This project will develop facilities for rearing and out-planting resident and anadromous fish in central and southern Idaho. The facility will be located near the American Falls Reservoir in Idaho. Resident fish include Yellowstone Cutthroat and Westslope Cutthroat trout. The anadromous fish include Snake River spring Chinook salmon and Snake River steelhead. The facility is sponsored by the Shoshone-Bannock Tribes, who are expected to operate and manage the facility once it is complete. The project will require development, review and approval of a Master Plan, completion of environmental analysis (including possibly a full EIS) and completion of other steps of the Council's 3-Step Review Process, including review by the ISRP.

- Yakima River Spring Chinook Supplementation Facility, located in Cle Elum, Washington: This project includes the construction of an interpretive building for public education at Bonneville's existing hatchery and for the design and construction of a monitoring and evaluation building at Nelson Springs for use by project biologists.

- Snake River Spring Chinook Salmon artificial propagation facilities (known as the Northeast Oregon Hatchery or NEOH); to be located on the Upper Grande Ronde River near La Grande, Oregon, on Catherine Creek near Union, Oregon, and on Lostine River near Enterprise, Oregon. While design has been ongoing for this project for several years, the decision to proceed with construction is pending approval by NOAA Fisheries of a Hatchery and Genetic Management Plan for the facility. This project, as a measure in the Council's Fish & Wildlife Program, would also identify and develop artificial propagation facilities to protect and enhance salmon and steelhead native to the Imnaha and Grande Ronde River Basins.

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

-Kootenai River Hatchery: The Kootenai River sturgeon hatchery, in Bonners Ferry, Idaho, is in need of hatchery upgrades and expansion to improve temperature control and rearing conditions that will result in the increased overall survival of these ESA-listed fish after release from this facility. In addition this may also include development of a burbot production facility to offset the loss of natural production below Libby Dam. The project requires development and review of a Master Plan prior to implementation.

-Nez Perce Tribal Hatchery: Additional rearing and acclimation facilities are requested as part of the existing Nez Perce Tribal Hatchery in Clearwater County, Idaho, for reintroduction of up to 700,000 coho smolts into the Clearwater River in Idaho. The Master Plan is complete and is under continuing review by regional entities, including the Council. The project will require an approved Master Plan prior to implementation. The Nez Perce Tribe (NPT) is motivated to implement the Clearwater Coho Restoration Project for the following reasons: 1) historically, coho salmon were one of the species making up a complex multi-species anadromous ecosystem within the Clearwater; and 2) coho salmon are a cultural resource to the NPT. The NPT goal is to restore coho salmon to the Clearwater sub-basin measured by 14,000 adults at Lower Granite Dam annually. Plans are to develop an integrated management plan to optimize the use of hatchery fish to meet recovery and harvest objectives.

-The NPT intend to seek an additional round of review for the Master Plan by the Council in 2011 with a goal of receiving a final recommendation to initiate environmental planning and design development in late 2011. Final design and construction approval would follow in late 2011 with possible construction starting in 2012.

- Redfish Lake Sockeye Salmon Captive Broodstock expansion: This project continues to expand the sockeye salmon captive broodstock program by constructing new or increasing the capacity of existing facilities at Eagle Hatchery in Eagle, Idaho, Burley Creek Fish Hatchery in Kitsap County Washington, and at Oxbow Hatchery in Multnomah County, Oregon, to meet the interim goal of increasing production to 150,000 sockeye salmon smolts per year. An additional site will be selected in Idaho to bring production annually to between 500,000 and 1,000,000 smolts as called for in the 2008 FCRPS BiOp. Project requires development and review of a Master Plan prior to implementation. Precipitous declines of Snake River sockeye salmon led to their Federal listing as endangered in 1991 (56 FR 58619). In that same year, the Idaho Department of Fish and Game (IDFG) initiated a Captive Broodstock Program for Snake River sockeye salmon to prevent species extinction. The ultimate program goal is to reestablish sockeye salmon runs to Stanley Basin waters and to provide for sport and treaty harvest opportunities. The program's near-term goal is to prevent species extinction, slow the loss of critical population genetic diversity and heterozygosity, and increase the number of individuals in the population.

- Chief Joseph Dam Hatchery: BPA is proposing to fund the Chief Joseph Dam Hatchery Program, a comprehensive management program for supplementing Chinook salmon to increase the abundance, productivity, distribution, and diversity of naturally spawning populations of spring/summer and fall Chinook in the Okanogan River and in the Columbia River below Chief Joseph Dam, Washington (between the confluence of the Okanogan River and Chief Joseph Dam).

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

Project includes a new hatchery facility (at the base of the Chief Joseph Dam) and acclimation ponds (throughout the Okanogan River sub-basin), broodstock collection, egg incubation, rearing, release, and selective broodstock collection method development. Planned production levels are 2 million summer/fall chinook and 0.9 million spring chinook smolts. Cost sharing for O&M and capital has been established with three public utility districts having some level of mitigation responsibility for their hydro projects within this geographic area.

- Klickitat Production Expansion: The Klickitat River Master Plan was completed by the Yakama Nation, reviewed by the ISRP, recommended by the Council, and approved by BPA in 2008. The plan's goal is to restore and maintain sustainable, naturally producing populations of spring chinook and steelhead that support tribal and non-tribal harvest and cultural and economic practices while protecting the biological integrity and the genetic diversity of indigenous fish stocks in the sub-basin. Consistent with the Klickitat Master Plan, in early 2009 BPA completed the Lyle Falls Environmental Impact Statement (EIS) and ROD. In 2009, final designs for construction of the Lyle and Castile Falls passage improvements, the enumeration and collection facilities at Lyle and Castile, as well as certain Klickitat hatchery upgrades necessary for maintenance of existing program activities and hatchery safety concerns are expected to be complete. Construction at Lyle Falls is to begin in fall 2009, with construction at Castile Falls and hatchery upgrades scheduled for summer of 2010. A new Klickitat Hatchery EIS was initiated in July 2009 that will examine options for the development and operation of new supplementation facilities and acclimation alternatives, and additional upgrades to the existing hatchery facility. This EIS is anticipated to be completed in spring 2011.

- Hood River Production Facility: This project includes expansion of existing Parkdale fish facility to accommodate spring chinook rearing, construction of new Hood River adult salmonid trapping facilities, and development of alternative adult trapping sites. Powerdale Dam, which is owned and operated by PacifiCorp, is scheduled for decommissioning during the summer of 2010. The dam forms an integral part of the Powerdale Dam Fish Trap, as fish are shunted into the fish trap as they ascend the fish ladder at the facility. Removal of the dam will also remove the fish trapping facility. The Powerdale Dam Fish Trap currently provides the foundation for many of the activities associated with implementation of the Hood River Production Program. These include: monitoring escapement, collecting life history characteristics, and broodstock acquisition. In order to continue implementing the production program, alternative trapping sites will need to be developed. The Hood River Production Program has four primary goals: 1) re-establish naturally sustaining runs of spring chinook in the Hood River; 2) re-build naturally sustaining runs of summer and winter steelhead in the Hood River; 3) maintain genetic characteristics of Hood River fish populations; and 4) provide fish for sustainable harvest by both sport and tribal fishers.

- Mid Columbia Coho restoration: Indigenous natural coho salmon no longer occupy the mid-Columbia river basins. Columbia coho salmon populations were decimated in the early 1900s. For several reasons, including the construction and operation of mainstem Columbia River hydropower projects, habitat degradation, release locations, harvest management, and hatchery practices and genetic guidelines, self-sustaining coho populations were not re-established in mid-Columbia basins. Currently, the lack of locally adapted stock and in-basin habitat degradation may be the biggest challenges to coho reintroduction in mid-Columbia tributaries. This program's vision is to re-establish naturally reproducing coho salmon populations in the Wenatchee and Methow sub-basins at biologically sustainable levels which provide significant harvest in most years.

Cultural, socio-economic, and ecological benefits are expected from the return of this species to areas where it once occurred in abundance. The phased approach, including associated facilities, incorporates development of a mid-Columbia hatchery broodstock, local adaptation to tributaries in the Wenatchee and Methow Basins, and habitat restoration that will benefit coho as well as ESA-listed spring chinook, steelhead, and bull trout.

- Walla Walla Hatchery: Hatchery planning and design, based on the Hatchery Master Plan, is near completion. The next phase of the project, pre-design and permitting (environmental compliance) is underway. Construction for the proposed facility is scheduled to begin in FY2011. When complete, the facility will hold, spawn, incubate and rear spring Chinook on the South Fork Walla Walla River near Milton-Freewater, Oregon.

-Yakama Coho restoration: The goal of this restoration project, including associated facilities, is to restore extirpated coho salmon to the Yakima River basin at biologically sustainable levels. Before the ocean and lower Columbia exploitation of salmon and steelhead in the late 19th century and early 20th century, and before the Yakima River valley was developed with extensive agricultural irrigation systems, the Yakima Sub-basin supported large runs of spring, summer and fall Chinook, summer steelhead, coho and sockeye. Historical returns of coho to the Yakima River Basin have been estimated in the range of 44,000 to more than 100,000 fish annually.

Cumulative effects from the disruption of the Yakima Sub-basin ecosystem functions and processes, out of sub-basin impacts, and harvest of salmon have resulted in a significant decline of fish and wildlife abundance from historic levels.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011

- Walla Walla River Juvenile and Adult Passage Improvements: This project would provide safe passage for migrating juvenile and adult salmonids in the Walla Walla Basin by constructing and maintaining passage facilities at irrigation diversion dams and canals.

Potential non-construction capital Wildlife and Resident Fish Habitat Acquisitions (Including Conservation Easements) eligible for capitalization:

- Grand Coulee and Chief Joseph Wildlife Habitat Acquisition
- Albeni Falls Wildlife Mitigation
- Palisades and Minidoka Wildlife Habitat Acquisition
- Black Canyon, Boise Diversion, Anderson Ranch Wildlife Habitat Acquisition
- Willamette Wildlife Habitat Acquisition
- Libby and Hungry Horse Reservoirs Resident Fish Acquisitions

	FY 2009	FY 2010	FY 2011
Conservation and Energy Efficiency	**17,988**	**33,495**	**40,331**

The conservation acquisition program offers several ways for customers to participate in regional conservation. Program components include: (1) utility standard offer and custom programs, which result in customer proposals to conserve energy through residential weatherization, commercial lighting, Heating, Ventilation, and Air Conditioning (HVAC), industrial processes and lighting, and irrigated agriculture; (2) third party delivery programs, such as residential compact fluorescent lighting, and the Energy Smart Grocer, Green Motors programs, and the Water and Waste Water Treatment Facilities program; (3) programs to help Federal installations in the region reduce energy use, which includes the Federal Hatcheries program and work at various dams to help the Corps and Reclamation in their efforts to reduce energy use; and (4) other initiatives still in the design stage.

	FY 2009	FY 2010	FY 2011
Total Power Services – Capital	**185,335**	**262,379**	**272,808**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Associated Project Costs	
▪ Reflects a reshaping of funding requirements based on the need to maintain a minimum level of generation each year.	+13,593
Fish and Wildlife	
▪ Reflects a reshaping of funding to implement Biological Opinions, Fish Accord commitments, and *Columbia Basin Fish and Wildlife Program* activities.	-10,000
Conservation and Energy Efficiency	
▪ Funding is consistent with the Council's most recent Power Plan.	+6,836
Total Funding Change, Power Services - Capital	**+10,429**

Transmission Services – Capital

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Transmission Services - Capital	FY 2009	FY 2010	FY 2011
Main Grid	47,509	180,119	193,821
Area & Customer Services	8,027	32,062	6,384
Upgrades & Additions	16,525	96,759	114,886
System Replacements	120,670	141,558	147,122
Projects Funded in Advance	184,000	77,403	77,179
Total, Transmission Services - Capital	376,731	527,901	539,392

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Transmission Services - Capital	604,915	515,656	473,089	487,977

Description

Transmission Services is responsible for about 75 percent of the Pacific Northwest's high-voltage transmission. TS provides for all additions, upgrades and replacements to the Federal BPA transmission system, resulting in reliable service to northwest generators and utility customers. The Federal BPA transmission system also facilitates the sale and exchange of power to and from the region.

The eastern blackout on August 14, 2003, alerted the Nation to the lack of investment in utility transmission infrastructure. BPA has been working on infrastructure investments and operational practices to improve the transmission grid since the West Coast disturbance on August 10, 1996. TS continues to make significant infrastructure improvements and additions to the system to assure reliable transmission in the Northwest. These improvements and additions will help the Federal transmission system continue to comply with national reliability standards, replace aging equipment, allow for interconnection of needed new generation, and remove constraints that limit economic trade or the ability to maintain the system. Prior to beginning the infrastructure improvements, TS had built no major transmission projects since 1987. Only incremental additions had been added to the system over the years.

The Northwest transmission system continues to show signs of stress, as two close calls in 2003 demonstrated. On June 4, 2003, voltage instability in the Spokane area was prevented by quick operator action on the Federal system. Two weeks later, the non-Federal transmission path between Montana and Idaho was overloaded for two days, and Washington operator adjustments prevented load loss. In 2004, it was noted that a small load change at BPA's interconnection with Idaho Power near LaGrande, Oregon was causing an unusually large voltage change. These examples demonstrate how the transmission system is being 'pushed' to its limits of capacity to carry power.

To maintain system reliability Bonneville has completed a number of infrastructure projects that have strengthened the electrical grid. The completion of the Grand Coulee-Bell, Kangley-Echo Lake, and Schultz-Wautoma line projects have provided dispatchers with greater Operational Transfer Capability and have reduced the likelihood of outages or reduction of transmission capacity for outage situations.

Bonneville's completed infrastructure investments that further strengthen the network consist of the following projects: Puget Sound Area Additions, North of Hanford/ North of John Day, Celilo Modernization, Eastern Washington Reinforcement, and Portland Area Additions.

These projects relieve congestion and contribute toward restoring an adequate reliability margin to the grid. They will be used to respond to a competitive market, meet regional load during outages, move power to meet changing loads and perform maintenance without harming the market.

In 2005, with the Congressional approval of wind tax credits, a number of potential wind generation companies made requests for connection to the BPA transmission grid. In 2007, BPA built facilities to connect up to 2500 MW of wind generation and connected 650 MW. In 2008, 659 MW was connected and in 2009, 795 MW was connected to the FCRPS grid. Bonneville has several thousand MW in additional wind project interconnection requests, many interconnecting in the 2010 through 2012 timeframe. BPA expects additions of 837 MW in 2010 and 1,370 MW in 2011. BPA plans a major construction phase in 2011-2013, building several new large substations to meet the interconnection requests. Current projections are for an additional approximately 1000 MW to interconnect in each of the years 2012 through 2015. Also in the interconnection queue is approximately 1000 MW of natural gas, bio-mass and geothermal fueled generation proposed for connection between 2012 and 2015. Much of the wind generation demand is a result of the Renewable Portfolio standards enacted by Oregon and Washington that require an estimated 5000 MW of renewable generation by 2015. Export to California could add another 2000-3000 MW during the same time period.

In June 2008, Bonneville concluded the first phase of its 2008 NOS. During that time, those desiring to secure long-term firm capacity on Bonneville's network transmission system where no existing capacity was available were required to sign agreements which committed them to take service at a specified time and under specified terms. BPA had received 153 requests from 28 customers for 6,410 MW of new service, about three-fourths for wind energy integration. BPA subsequently offered 1,782 MW of new transmission service on its existing system. Bonneville identified four new Main Grid capital projects from the 2008 NOS: (1) McNary-John

Day 500 kV transmission line (part of West of McNary Reinforcements Group 1), (2) Big Eddy-Knight 500 kV transmission line and substation (part of West of McNary Reinforcements Group 2), (3) Central Ferry- Lower Monumental 500kV Reinforcement (formerly Little Goose Area Reinforcement), and (4) I-5 Corridor 500 kV Reinforcement. These projects will provide almost 3,700 MW of new transmission service. Contingent upon NEPA review, Bonneville will construct the new facilities and provide service at embedded rates.

System Replacements: Bonneville's Transmission Asset Management Sustain Program replaces high-risk, obsolete, and maintenance-intensive facilities and equipment and reduce the chance of equipment failure by: 1) replacing high voltage transformers and power circuit breakers which are at or near the end of their useful life; 2) replacing risky, outdated and obsolete Control Center and control and communications equipment and systems; and includes replacements provided for in the Commercial Spectrum Enhancement Act (CSE Act) (under PFIA); and 3) replacing all other existing high-risk equipment and facilities affecting the safety and reliability of the transmission system.

As noted, Bonneville's capital program for Transmission Services includes a wide variety of specific investments that are determined after internal review and in some cases external review. On occasion, capital investments must be made on short notice because of unexpected needs, because of the identification of obsolete, worn out, failed, failing, or at risk systems and facilities, because of system reliability requirements, and because near-term opportunities to install or construct facilities arise as outages occur or as schedules for outages change. For these and other reasons, Transmission Services capital program is fluid and subject to change. Thus, Bonneville is unable to predict with particularity many of the new capital investments in the transmission system. Nonetheless the types of investments can be identified in general. These items may include but are not limited to: arrestor, braking resistor, bus and bus pedestal, circuit breaker, circuit switcher, communication tower, concrete pole, control center mapboard and video wall displays, control house, converter grading capacitors, converter harmonic filters, converter smoothing reactors, converter transformers, current limiting reactor, current limiting resistor, current transformer, digital fault locator, digital cross-connect system (DCS), disconnect switch, engine generator, engineered steel pole, fiber optic cable, fiber terminal, fuel dispensing facility, grounding system, grounding transformer, microwave multiplex transmitter, network management system (NMS), overhead conductor, overhead ground wire, power transformer, radio multiples transmitter, relay, revenue meter, series capacitor, shunt capacitor, shunt reactor, station service transformer, station service inverter, substation dead end tower, substation perimeter fence, switchyard lighting, thyristor, transfer switch, transmission steel tower, voltage regulator, voltage transformer, water/sewer system, wood pole and cross-arm, and other similar items consistent with Bonneville's capitalization policy determinations (such as spacer damper replacements).

Notwithstanding that the capital program for Transmission Service is subject to change, Bonneville has identified several general areas where capital program investment will occur.

Bonneville will continue to fund fiber optic communications facilities needed to meet Bonneville's projected operational needs. To the extent that these investments create temporary periods of excess fiber optic capacity, such dark fiber capacity can be made available to telecommunications providers and to non-profits to meet public benefit Internet access needs for rural areas and other needs in Bonneville's service area. Bonneville's investments in fiber optics, including the role of the private sector in building fiber optic networks, is consistent with the "Fiber Optic Cable Plan" submitted to Congress on May 24, 2000, accompanying the FY 2000 Energy and Water Development Appropriations Act. In accordance with this plan, when possible, Bonneville will establish partnerships with fiber optic facility and service providers to meet its needs.

In December 2004, the Congress passed and the President signed the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494), creating the Spectrum Relocation Fund (SRF) to streamline the relocation of Federal systems from certain spectrum bands to accommodate commercial use by facilitating reimbursement to affected agencies of relocation costs. The Federal Communications Commission has auctioned licenses for reallocated Federal spectrum, which will facilitate the provision of Advanced Wireless Services to consumers. Funds were made available to agencies in FY 2007 for relocation of communications systems operating on the affected spectrum. These funds are mandatory and will remain available until expended, and agencies will return to the SRF any amounts received in excess of actual relocation costs. The estimated BPA cost of this relocation is $48.7 million.

As part of the Homeland Security Presidential Directives, Bonneville has completed a physical security assessment of all critical facilities and is implementing security enhancements at these facilities. These security enhancements increase access control to BPA's facilities and provide video surveillance and monitoring capabilities.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Main Grid	**47,509**	**180,119**	**193,821**

Bonneville's strategic objectives for Main Grid projects are to provide voltage support; provide a reliable transmission system for open access, per NERC criteria; provide for relief of transmission system congestion; and assure compliance with the NERC and Western Electricity Coordinating Council (WECC) reliability standards, and with BPA reliability criteria and guidelines. During this budgeting period, projects are planned that will provide voltage support to major load areas that are primarily west of the Cascade Mountains, and transmission reinforcements to load centers in central Oregon, central Washington, and the Willamette Valley, and provide for transmission access for new generation projects to the load center. Reinforcements along the Interstate-5 corridor are also planned.

- FY 2009: (1) Began environmental analysis and preliminary engineering for the I-5 Corridor Reinforcement project; (2) Continued the construction of the Libby-Troy 115KV transmission line upgrade; (3) Continued the construction for the Olympic Peninsula Reinforcement project; (4) West of McNary Reinforcements Group 1- continued design and procurement of materials and started construction (this project was

(dollars in thousands)

FY 2009	FY 2010	FY 2011

attributed to ARRA); (5) West of McNary Reinforcements Group 2- continued environmental and preliminary design; (6) Began design and ordering materials for the Redmond 230/115 kv bank #2; (7) Central Ferry- Lower Monumental 500 kV Reinforcement (formerly Little Goose Area Reinforcement)- continued environmental review and preliminary design; (8) Continued planning studies to identify and develop plans of service for needed infrastructure additions; (9) Continued planning studies and design to identify projects driven by NERC/ WECC reliability standards; (10) Continued planning studies to identify system reactive needs to mitigate unacceptable low or high voltage problems and other system additions; (11) Continued planning studies to relieve transmission system congestion and for integrating potential new generation facilities; and (12) Began planning studies for the NOS.

- FY 2010: (1) Continue environmental analysis and preliminary engineering design for the I-5 Corridor Reinforcement project; (2) Complete construction of the Libby-Troy 115KV transmission line upgrade; (3) Complete construction of the Olympic Peninsula Reinforcement project; (4) West of McNary Reinforcements Group 1 (WOMR 1)- complete design, procurement of materials, and continue construction; (5) West of McNary Reinforcements Group 2 (WOMR 2)- continue environmental review and preliminary design; (6) Complete the design and begin construction for the Redmond 230/115 kv Bank #2; (7) Continue planning studies to identify needed infrastructure additions; (8) Central Ferry- Lower Monumental 500 kV Reinforcement (formerly Little Goose Area Reinforcement)- continue environmental review and preliminary design; (9) Continue planning studies and design to identify projects driven by NERC/ WECC Reliability standards; (10) Continue planning studies to identify system reactive needs to mitigate unacceptable low or high voltage problems and other system additions; (11) Continue planning studies to relieve transmission system congestion and for integrating potential new generation facilities; (12) Continue planning studies and design for projects related to the NOS.

- FY 2011: (1) Continue environmental analysis and continue design for the I-5 Corridor Reinforcement project; (2) West of McNary Reinforcements Group 1 (WOMR 1)- continue construction; (3) West of McNary Reinforcements Group 2 (WOMR 2)- complete environmental review and preliminary design; (4) Continue construction for the Redmond 230/115 kv Bank #2; (5) Central Ferry- Lower Monumental 500 kV Reinforcement (formerly Little Goose Area Reinforcement)- continue environmental review and preliminary design; (6) Continue planning studies to identify needed infrastructure additions; (7) Continue planning studies and design to identify projects driven by NERC/ WECC reliability standards; (8) Continue planning studies to identify system reactive needs to mitigate unacceptable low or high voltage problems and other system additions; (9) Continue planning studies to relieve transmission system congestion and for integrating potential new generation facilities; (10) Continue planning studies and design for projects related to the NOS.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Area and Customer Services	**8,027**	**32,062**	**6,384**

Bonneville's strategic objective for Area and Customer Service projects is to assure that Bonneville meets any reliability standards and our contractual obligations.

- FY 2009: (1) Continued construction of the SVC at Rogue Substation; (2) Construction of Hooper Springs substation was on hold pending completion of negotiations and agreements between the participants; (3) Continued the construction on the City of Centralia Reinforcement Project; (4) Began the design and material ordering of the Drummond Shunt Capacitors; (5) Began design and material ordering for the Albany-Eugene Rebuild; (6) Began the design and material ordering for the Lebanon 115 kv shunt capacitors; (7) Continued preliminary engineering and design for miscellaneous facilities required to meet contractual obligations and maintain reliable service for BPA's service area.

- FY 2010: (1) Complete construction of the SVC at Rouge Substation; (2) Begin the design and material ordering and start the construction of Hooper Springs substation; (3) Continue the construction on the City of Centralia Reinforcement Project; (4) Complete design and construction of the Drummond Shunt Capacitors; (5) Complete the construction of the Albany-Eugene Rebuild; (6) Complete the construction of the Lebanon 115 kv shunt capacitors; (7) Continue preliminary engineering and design for miscellaneous facilities required to meet contractual obligations and maintain reliable service for BPA's service area.

- FY 2011: (1) Complete the construction of Hooper Springs substation; (2) Continue the construction on the City of Centralia Reinforcement Project; (3) Continue preliminary engineering and design for miscellaneous facilities required to meet contractual obligations and maintain reliable service for BPA's service area.

Upgrades & Additions	**16,525**	**96,759**	**114,886**

Bonneville's strategic objectives for Upgrades and Additions are to replace older communications and controls with newer technology including fiber optics in order to maintain or enhance the capabilities of the transmission system; to implement special remedial action control schemes to accommodate new generation and mitigate immediate operational and market constrained paths; and to support communications and remedial action schemes, among other proposals.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

During this budget period, BPA will complete design, material acquisition, construction and activation of several fiber optics facilities to provide bandwidth capacity and high-speed data transfers to eventually replace microwave analog radios, which are technologically obsolete and nearing the end of their useful life. Temporarily, in some areas, excess fiber capacity is being offered for a term to telecommunications providers or to public entities such as public utilities, schools, libraries, and hospitals, providing them access to high-speed telecommunication services as a public benefit.

- FY 2009: (1) Continued material acquisition and completed construction for Maple Valley – SnoKing - Snohomish fiber project; (2) Ordered materials and completed construction on the 2 mile taps for Sifton and Kennewick fiber projects; (3) Ordered materials and completed construction on the 1 mile tap for Augspunger fiber project; (4) Began planning for upgrading 2 miles of fiber between Bonneville power house and Bonneville control house; (5) Completed design and construction of seismic upgrade projects; (6) Continued planning, design, material acquisition and construction of special remedial action control schemes required for interconnecting new generation projects and mitigating immediate constrained paths; (7) Continued planning, design, material acquisition and construction of various system additions and upgrades necessary to maintain a reliable system for BPA's service area; (8) Continued construction of secondary fiber related projects and digital radio system upgrades to improve the operational telecommunication system; (9) Began planning and preliminary design to upgrade the main fiber optic backbone system (# KC and #NC systems); (10) Began planning and technical feasibility studies for upgrade of the Pacific DC Intertie from 3100 to 3800 MW.

- FY 2010: (1) Negotiate and draft agreement(s) for joint use fiber project from SnoKing to Bellingham; (2) Continue planning for upgrading 2 miles of fiber between Bonneville Power House and Bonneville Control House; (3) Continue planning, design, material acquisition and construction of special remedial action control schemes required for interconnecting new generation projects and mitigating immediate constrained paths; (4) Continue planning, design, material acquisition and construction of various system additions and upgrades necessary to maintain a reliable system for BPA's service area; (5) Continue construction of secondary fiber related projects and digital radio system upgrades to improve the operational telecommunication system; (6) Continue design and begin material procurement and construction to upgrade the main fiber optic backbone system (#KC and #NC systems); (7) Begin planning and preliminary design for VHF Radio System upgrade; (8) Continue planning and technical studies for upgrade of the Pacific DC Intertie from 3100 to 3800 MW

- FY 2011: (1) Complete joint use fiber project from SnoKing to Bellingham; (2) Begin design of upgrading 2 miles of fiber between Bonneville Power House and Bonneville Control House; (3) Continue planning, design, material acquisition and construction of special remedial action control schemes required for interconnecting new generation projects and mitigating immediate constrained paths; (4) Continue planning, design, material acquisition and construction of various system additions and upgrades necessary to maintain a reliable system for BPA's service area; (5) Continue construction of secondary fiber related projects and digital radio system upgrades to improve the operational telecommunication system; (6) Continue design and begin material procurement and construction to upgrade the main fiber optic backbone system (#KC and #NC systems); (7) Continue design and construction of the VHF Radio System upgrade; (8) Begin planning and preliminary design to upgrade the Ross-Franklin fiber optic route; (9) Begin design and equipment acquisition for upgrading the Pacific DC Intertie to 3800 MW.

	FY 2009	FY 2010	FY 2011
System Replacements	**120,670**	**141,558**	**147,122**

Bonneville's strategic objectives for the Sustain Program are to replace high-risk, obsolete, and maintenance-intensive facilities and equipment and to reduce the chance of equipment failure by (1) replacing high voltage transformers and power circuit breakers which are at or near the end of their useful life; (2) replacing risky, outdated and obsolete control and communications equipment and systems, and includes replacements resulting from legislation; and (3) replacing all other existing high-risk equipment and facilities affecting the safety and reliability of the transmission system.

Non-Electric Replacements:

- FY 2009: (1) Completed non-electric replacements as necessary; (2) Continued seismic upgrades to substations and buildings; (3) Continued the design, material acquisition, and construction for the Access Road Program capital component; (4) Received delivery of two helicopters; (5) Continued design and construction of capital improvements for identified existing facilities.

- FY 2010: (1) Complete non-electric replacements as necessary; (2) Continue seismic upgrades to substation bus risers; (3) Continue the design, material acquisition, and construction for the Access Road Program capital component; (4) Receive delivery of one helicopter; (5) Complete a NEPA review and feasibility study for construction of the Transmission Services Facility, which would be part of the Ross Complex; (6) Continued design and construction of capital improvements for identified existing facilities.

- FY 2011: (1) Continue non-electric replacements as necessary; (2) Continue seismic upgrades to substation bus risers; (3) Continue the design, material acquisition, and construction for the Access Road Program capital component; (4) Begin design and construction of the Transmission Services Facility, which would be part of the Ross Complex,

(dollars in thousands)

FY 2009	FY 2010	FY 2011

based on results of the review and feasibility study; (5) Continued design and construction of capital improvements for identified existing facilities.

Electric Replacements:

- FY 2009: (1) Continued replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using Reliability Centered Maintenance (RCM) criteria. Such replacements include relays, annunciators, oscillographs, metering and replacing and migrating analog to digital technology and Supervisory Control and Data Acquisition (SCADA) equipment; (2) Continued replacement of under-rated and high maintenance substation equipment; (3) Continued replacing spacer dampers on various 500kV lines; (4) Continued replacing critical, operational tools and marketing business systems at the Dittmer and Munro Control Centers; (5) Continued replacing deteriorating wood pole transmission line structures and insulators with Non-Ceramic Insulators (NCI).

- FY 2010: (1) Continue replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using RCM criteria. Such replacements include relays, annunciators, oscillographs, metering and various types of communication related equipment replacing and migrating analog to digital technology and SCADA equipment; (2) Continue replacement of under-rated and high maintenance substation equipment; (3) Continue replacing spacer dampers on various 500kV lines; (4) Continue replacing critical, operational tools and marketing business systems at the Dittmer and Munro Control Centers; (5) Continue replacing deteriorating wood pole transmission line structures, spacer dampers and insulators with NCI;
(6) Determine whether to proceed with initiating replacement of Celilo converter control systems and smoothing reactors in its present configuration or do a facility upgrade to a new simplified configuration (pending southern party's system study results)..

- FY 2011: (1) Continue replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using RCM criteria. Such replacements include relays, annunciators, oscillographs, metering and various types of communication related equipment replacing and migrating analog to digital technology and SCADA equipment; (2) Continue replacement of under-rated and high maintenance substation equipment; (3) Continue replacing spacer dampers on various 500kV lines; (4) Continue replacing critical, operational tools and marketing business systems at the Dittmer and Munro Control Centers; (5) Continue replacing deteriorating wood pole transmission line structures, spacer dampers and insulators with NCI; (6 Initiate replacement of Celilo converter control systems and smoothing reactors or facility upgrade --- based on outcome of southern party's system studies; (7) Initiate replacement of aging and defective converter transformers.

	(dollars in thousands) FY 2009	 FY 2010	 FY 2011
Projects Funded in Advance	**184,000**	**77,403**	**77,179**

This category includes those facilities and/or equipment where BPA retains control or ownership but which are funded or financed by a third party or with revenues, either in total or in part. This category also includes investments associated with the CSE Act.

- FY 2009: (1) Continued to integrate various new generation projects into BPA transmission grid in response to Interconnection Requests submitted via the Large and Small Generation Interconnection procedures contained in BPA's Open Access Transmission Tariff; (2) Continued to implement Line/Load Interconnections in accordance with Attachment J of BPA's Open Access Transmission Tariff; (3) Completed planning studies to identify system impacts and needs regarding proposed new generation and line/load projects; (4) Continued environmental cleanup and other work necessary for the sale of BPA facilities; (5) Completed other projects as agreed to with customers; (6) Continued design and started construction for the radio replacements associated with the CSE Act; (7) Completed design, material ordering and began construction of the COI reinforcement project.

- FY 2010: (1) Continue to integrate various new generation and line/load projects into BPA transmission grid per Interconnection Requests via the Open Access Transmission Tariff; (2) Continue planning studies to identify system impacts and needs regarding proposed new generation projects; (3) Perform environmental work and preliminary engineering for several large wind generation interconnection substations; (4) Complete environmental cleanup and other work necessary for the sale of BPA facilities; (5) Complete other projects as agreed to with customers; (6) Continue the design and construction for various radio replacements at accessible sites associated with the CSE Act; (7) Continue construction of the COI reinforcement project.

- FY 2011: (1) Continue to integrate various new generation and line/load projects into BPA transmission grid per Interconnection Requests via the Open Access Transmission Tariff; (2) Continue planning studies to identify system impacts and needs regarding proposed new generation projects; (3) Engineer and begin construction of several large wind generation interconnection substations; (4) Complete environmental cleanup and other work necessary for the sale of BPA facilities; (5) Complete other projects as agreed to with customers; (6) Continue the design and construction for various radio replacements at accessible sites associated with the CSE Act; (7) Continue construction of the COI reinforcement project.

Total, Transmission Services – Capital	**376,731**	**527,901**	**539,392**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Main Grid	
▪ Reflects increase to accommodate new projects associated with updated power flow study results, NERC compliance, and NOS additions.	+13,702
Area & Customer Services	
▪ Reflects decrease in the number of new customer service projects.	-25,678
Upgrades & Additions	
▪ Reflects increase on both system wide controls schemes, fiber projects and communications upgrades, improvements and additions to other transmission facilities, and the addition critical spare transformers at select locations.	+18,127
System Replacements	
▪ Reflects continuing focus on BPA's Transmission Asset Management Sustain Program.	+5,564
Projects Funded in Advance	
▪ Reflects continuing focus of large customer funded projects related to generation integration, much of which is in support of new wind generation integration.	-224
Total Funding Change, Transmission Services - Capital	+11,491

Capital IT & Equipment/Capitalized Bond Premium

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Capital IT & Equipment/Capitalized Bond Premium	FY 2009	FY 2010	FY 2011
Capital Information Technologies (IT) & Equipment	31,092	23,723	22,389
Capitalized Bond Premium	0	0	1,500
Total, Capital IT & Equipment/Capitalized Bond Premium	31,092	23,723	23,889

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Capital IT & Equipment/Capitalized Bond Premium	28,782	28,923	29,297	29,884

Description

Capital Information Technologies provides for the acquisition of general and some dedicated special purpose capital information technologies, and acquisition of special-use capital and IT equipment in support of Bonneville's strategic objectives. This category also includes BPA's on-going efforts to facilitate delivery of a highly resilient organization, able to anticipate, withstand and effectively respond to disruptive events affecting it and its partners in the Northwest region. The four main areas of resiliency focus include asset management, emergency management, crisis management and continuity of operations.

As part of a major efficiency effort, BPA continues to move its IT infrastructure to a more efficient architecture. This FY 2011 budget supports, in part, this effort. IT continues to eliminate redundancies in tools and applications, establish an agency-wide IT architecture with standardized IT purchasing criteria, standardize software licensing processes and minimize agency liabilities through stronger contracts, apply continuous improvement practices to IT project management, and implement an agency IT portfolio cost management strategy. The IT estimates in this FY 2011 budget, under Capital Information Technologies and Equipment include all IT functions within the agency except TS grid operations. See the Capital Program – Transmission Services section of this budget for additional discussion of transmission-related IT requirements acquisitions.

Capital equipment provides for the acquisition of general and some dedicated special purchases of capital office furniture and equipment.

Bonneville incurs a bond premium whenever it repays a Treasury bond before the due date. When bonds are refinanced, the bond premiums incurred are capitalized. Historically, Bonneville generally has chosen to finance capitalized bond premiums with bonds issued to the Treasury, as was envisioned in the Transmission System Act of 1974.

Detailed Justification

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Capital Information Technology/Equipment	**31,092**	**23,723**	**22,389**

Includes enhancements to Bonneville's information technology processes to provide cost effective efficiencies for secure, timely and accurate information. Continue enhancements to Bonneville's Enterprise systems that are designed to link key information systems throughout Bonneville and improve business processes. Current efforts include continued functional process improvements in areas not included in the initial development phase. Acquire capital office furniture and equipment, capital automated data processing (ADP) based administrative telecommunications equipment, ADP equipment (hardware), and support capital software development for certain Bonneville programs.

	FY 2009	FY 2010	FY 2011
Capitalized Bond Premium.	**0**	**0**	**1,500**

- Continue to assess financial market and when cost-effective, refinance available bonds as prudent.

	FY 2009	FY 2010	FY 2011
Total, Capital IT & Equipment/Capitalized Bond Premium	**31,092**	**23,723**	**23,889**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Capital Information Technology & Equipment	
▪ Reflects Enterprise Process Improvement Program (EPIP) efficiencies.	-1,334
Capitalized Bond Premium	
▪ Reflects possibility of calling bonds in FY 2011.	+1,500
Total Funding Change, Capital Equipment/Capital Bond Premium	**+166**

Power Services - Operating Expense

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Power Services - Operating Expenses	FY 2009	FY 2010	FY 2011
Production	922,760	1,333,534	1,497,395
Associated Projects Costs	295,578	323,306	334,777
Fish & Wildlife	177,369	215,000	236,000
Residential Exchange Program	205,171	265,558	270,087
NW Power & Conservation Council	9,424	9,683	9,934
Conservation and Energy Efficiency	99,444	140,572	141,386
Total, Power Services - Operating Expenses	1,709,746	2,287,653	2,489,579

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Power Services - Operating Expense	3,165,241	3,239,344	3,259,738	2,677,073

Description

Production includes all Bonneville non-Federal debt service (including EN debt), O&M of power system generation resources, including a large nuclear plant, business operations, short- and long-term power purchases, electric utility marketing of power, and oversight of hydro and nuclear projects. BPA develops products and services to meet the needs of Bonneville customers and stakeholders, and acquires resources as needed. This FY 2011 budget includes anticipated expenses for new long-term power purchases to meet the needs of Bonneville customers, that may include no more than 30 MW of waste energy recovery power acquired through a demonstration project testing the effectiveness of a "standard offer" approach to acquiring certified Clean Energy projects as defined in the Energy Independence and Security Act of 2007 (Public Law 110-140 December 19, 2007).

During FY 2009 and 2010, BPA will be developing a long-term resource program to guide future resource acquisitions needed to meet customer loads. This plan is expected to be completed in time for acquisitions to begin as necessary in FY 2011. Once the plan is complete, BPA will modify its budget as needed to reflect expected acquisitions.

EN debt is one of Bonneville's largest expense components. BPA, in collaboration with EN, is pursuing the refinancing of certain EN bonds as part of an ongoing debt optimization program. Through this program, BPA uses the reductions in debt service for its EN bonds to make advance payments on its Federal debt. Implementation of the refinancing components will be subject to favorable market conditions and interest rate environment.

Bonneville's Power Transacting Risk Management Policy permits the use of power financial instruments to hedge Bonneville's exposure to market price risk and certain index sales contract provisions.

Associated Projects represents funding for operation and maintenance costs for the FCRPS, minor additions, improvements and replacements, and liabilities of the Corps and Reclamation hydroelectric projects in the Pacific Northwest, which serve many purposes. All agencies emphasize efficient power production from existing facilities and improvement of the performance and availability of power generating units. Bonneville pays additional financing costs of the FCRPS facilities through its Interest Expense and Capital Transfer budget programs. Bonneville provides funding for the operations and maintenance costs that are part of the Lower Snake River Compensation Plan (LSRCP) hatcheries. Bonneville is responsible for annual payments to the Confederated Tribes of the Colville Reservation for their claims concerning their contribution to the production of hydropower by the Grand Coulee Dam in accordance with the Settlement Agreement between the United States and the Tribes (April 1994).

Bonneville's Fish and Wildlife program provides for extensive protection, enhancement, and mitigation of Columbia River Basin fish and wildlife adversely affected by the development and operation of Federal hydroelectric projects on the Columbia River and its tributaries from which Bonneville markets power. Bonneville satisfies a major portion of its fish and wildlife responsibilities by funding projects and activities designed to be consistent with the Council Fish and Wildlife Program (Program) developed pursuant to Section 4(h) of the Northwest Power Act. Through the Program BPA also implements measures to aid in the recovery of fish in the Columbia River and its tributaries, listed as threatened or endangered under the ESA. Bonneville pursues a comprehensive approach to integrate the ESA requirements of the FCRPS biological opinions with the broad resource protection, mitigation and enhancement objectives of the Program.

Bonneville implements these measures addressed to salmon and steelhead recovery required under the ESA as part of the most recent FCRPS Biological Opinions issued in 2006 by the USFWS (2006 BiOp), in May 2008 (2008 BiOp) and July 2008 (Willamette BiOp) by NOAA Fisheries, to address the effects of the operation of the FCRPS on threatened and endangered salmon, steelhead, Kootenai River white sturgeon, and bull trout. The Biological Opinions require the FCRPS Action Agencies to implement actions in the Columbia River Basin that address impacts of the Federal hydrosystem on ESA-listed fish to ensure that operation of the FCRPS does not jeopardize the continued existence of listed species or adversely modify their designated critical habitat.

NOAA Fisheries issued its 2008 FCRPS BiOp in May 2008. It replaces the 2004 BiOp that was challenged and remanded. The new opinion includes, with few modifications, the spill that the Court ordered as temporary injunctive relief in 2006. The 2008 BiOp was developed through a court-ordered collaboration process over the past two years. In addition, in 2008, the FCRPS Action Agencies signed agreements, the Columbia Basin Fish Accords (Fish Accords) with five Northwest Tribes and the states of Idaho and Montana. In 2009, agreements were signed with another tribe, federal agencies, and the State of Washington. The Fish Accords supplement the 2008 BiOp and the Council's Fish and Wildlife Program and provide firm commitments to mitigation actions and secure funding for the next 10 years.

There has also been litigation directed at the USFWS Biological Opinions for Kootenai River white sturgeon. In 2003, the Corps and BPA reinitiated consultation for the operations at Libby

Dam to address impacts to recently designated critical habitat for the Kootenai River white sturgeon, and to evaluate information that had been developed on Kootenai River white sturgeon and bull trout since the 2000 USFWS BiOp. That consultation was completed in February 2006, but was challenged by environmental groups, the Kootenai Tribe, and the State of Montana in Federal District Court of Montana. This litigation was settled in March 2009 and includes a combination of hatchery, habitat and flow/spill actions subject to modification depending on the results.

Also, NOAA Fisheries and USFWS issued a Biological Opinion on the FCRPS projects in the Willamette Basin in July, 2008. This BiOp includes a combination of hatchery, habitat and operational actions. Additionally, studies will be conducted to determine potential configuration actions to improve productivity of listed stocks.

Bonneville's mitigation and recovery expenditures will focus on activities that benefit Columbia River Basin fish and wildlife resources including projects, following priorities established in Council Sub-basin Plans, designed to:

- increase survival of ESA-listed and non-listed fish at FCRPS dams and reservoirs;
- increase survival of ESA-listed and non-listed fish throughout their life cycle by protecting and enhancing important habitat areas;
- reform hatchery practices that affect ESA-listed populations and use hatcheries to contribute to conservation and recovery of ESA-listed and non-listed fish;
- provide for offsite mitigation projects for habitat, passage, and other improvements that address limiting factors for target species as defined in Sub-basin Plans;
- reduce harvest-related mortality on ESA-listed and non-listed fish and support sustainable fisheries; and
- support a focused and well-coordinated research, monitoring, and evaluation program.

To the extent possible, Bonneville is integrating the actions implemented in response to the FCRPS BiOps with projects implemented under the Council's Fish and Wildlife Program. Sub-basin plans that include prioritized strategies for mitigation actions will help guide project selection that meets both BPA's ESA and Northwest Power Act responsibilities. In order to address the *in lieu* provision of the Northwest Power Act, which prohibits BPA from funding mitigation that other entities are authorized or requires to undertake, BPA continues its ongoing work with the Council and the regional fish and wildlife managers, customers, and Tribes to review projects to ensure ratepayers fund appropriate mitigation. For example, BPA established a cost sharing MOU with the U.S. Forest Service in 2005 that requires a programmatic 30 percent cost share for FYs 2007-2009 for fish mitigation projects funded by BPA on U.S. Forest Service lands. BPA anticipates extending the MOU beyond 2009 and is in discussions with the U.S. Forest Service on this matter.

The Energy and Water Development Appropriations Act of 1996 added section 4(h)(10)(D) to the Northwest Power Act, directing the Council to appoint an Independent Science Review Panel (ISRP) "to review a sufficient number of projects" proposed to be funded through Bonneville's fish and wildlife budget "to adequately ensure that the list of prioritized projects recommended is consistent with the Council's program." The Northwest Power Act further states that "in making its recommendations to Bonneville, the Council shall consider the impact of ocean conditions on fish and wildlife populations and shall determine whether the projects employ cost effective measures to achieve program objectives." Today, most mitigation projects funded by Bonneville receive ISRP review as part of the Council recommendation process. The Council has shifted to a multi-year project review cycle during which the ISRP will review categories of projects grouped together; e.g., all terrestrial wildlife projects were recently reviewed. The Council plans to complete their cycle in 2011.

The Northwest Power Act created the Residential Exchange Program to extend the benefits of low-cost Federal power to certain residential and small farm power users in the Region. In effect, the program has resulted in cash payments by Bonneville to exchanging utilities, which are required to pass the benefit of the cash payments through in its entirety to eligible residential and small farm customers.

Under the Residential Exchange Program, Bonneville is to "purchase power" offered by an exchanging utility at its "average system cost," which is determined by Bonneville through the application of a methodology limiting the costs that may be included in an exchanging utility's average system cost to the production and transmission costs that an exchanging utility incurs for power. Bonneville is then to offer an identical amount of power for "sale" to the utility for the purpose of resale to the exchanging utility's residential users. In reality, no power has changed hands. Bonneville instead has made cash payments to exchanging utilities in an amount determined by multiplying an exchanging utility's eligible residential load times the difference between the exchanging utility's average system cost and Bonneville's applicable Residential Exchange Rate (which is an adjusted version of the PF Rate), if such rate is lower.

On May 3, 2007, the Court held that the REP Settlement Agreements were inconsistent with the Northwest Power Act and that the settlement costs were improperly allocated in setting the PF rate.

The WP-07 Supplemental rate case responded to the Court's rulings and revised power rates for FY 2009. This rate case also established the amount by which the preference customers were overcharged in FY 2002-2008 due to the REP Settlement Agreements found to be in violation of the Northwest Power Act by the Court. It also determined the approach to recovering those overcharges from the IOUs and returning them to the Preference customers who paid the too-high PF rates. The WP-07 Supplemental ROD, studies and documentation for the WP-07 Supplemental rate case determined the PF Exchange rate for FY 2009, as well as the magnitude of the initial amount to be returned to the Preference customers in FY 2009 for overcharges during FY 2002-2006.

The Council's major activities include the periodic preparation of a Northwest Conservation and Electric Power Plan (a 20-year electric energy demand and resources forecast and energy conservation program) and a Columbia River Basin Fish and Wildlife Program of loss mitigation and resource enhancement actions. The Northwest Power Act directs that expenses of the Council, subject to certain limits based on forecasted Bonneville power sales, shall be included in Bonneville's annual budget to Congress. Funding for the Council is provided by Bonneville and is recovered through Bonneville power rates.

BPA will acquire conservation resources consistent with the Council's Power Plan and act as a catalyst for energy efficiency. Such action will: 1) meet conservation targets; 2) achieve a least cost resource mix; 3) lessen the cost impacts of power purchases; 4) avoid the costs of ramping programs and infrastructure up and down; 5) extend the value of the FCRPS to customers; and 6) build the region's resource portfolio with conservation. Bonneville is also exploring how best to integrate demand-side management, distributed generation, and other leading edge technologies (i.e., Energy Web and Smart Grid applications) into its generation and transmission planning processes.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Production	**922,760**	**1,333,534**	**1,497,395**

- Power Purchases: Includes purchased power to cover power supply obligations as well as balancing the hydro system. These purchases can be made in the form of long-term purchases to meet supply obligations based on long-term planning requirements or they can be made within the year due to the monthly shape of the loads and the monthly shape of the hydro electric generation. Also, purchases can be made within the month and within the day to fill shortages due to fluctuations in the hydro system and load changes.

- Power Scheduling/Marketing: Schedule and market (buy/sell) electric energy with Bonneville customers and the Pacific Northwest's interconnected utilities. Scheduling includes PS's implementation of physical and memo power schedules and associated transmission schedules, implementation of Electronic Tagging (ETag) in accordance with NERC and in accordance with FERC, implementation of electronic scheduling and the Columbia Grid as it evolves.

- Trojan: Decommissioning activities are complete and the Trojan operating license has been terminated by the NRC. BPA's 30 percent share of the operation and maintenance costs for the Independent Spent Fuel Storage Installation facility continues.

- Columbia Generating Station (formerly WNP-2): Continue to acquire full capability of Columbia Generating Station (CGS). CGS is on a 24-month fuel and outage cycle. A maintenance and refueling outage is planned for the spring of FY 2011.

- WNP-1/WNP-3: Continue to fulfill contractual obligations for WNP-1 and WNP-3.

- Long Term Power Purchases and Wheeling: Continue to acquire 100 percent of the following wind projects: Foote Creek II (2 MW) and IV (17 MW), Condon (50 MW) and Klondike I (24 MW). BPA continues to purchase 15 MW of Foote Creek I, 90 MW of the Stateline wind project, and 50 MW of the Klondike III wind project. Wind purchases now total 248 MW. BPA also continues to purchase a share of the output from the Solar Ashland Project.

Generation and Oversight:

FY 2009: Provided oversight of all signed contracts including oversight of large thermal generating plants from which Bonneville purchases capability to ensure that all Bonneville approval rights are protected; coordinated, communicated, and administered agreements, issues, and programs between Bonneville and the project owners. Continued to provide wind resource integration services for customer wind generation.

FY 2010: Continue to provide oversight of all contracts signed to date. Pursue cost-effective means to mitigate capacity demands associated with interconnecting large amounts of wind into the BPA system. Pursue acquisition of additional cost-effective renewable generation to meet load growth. Continue to provide oversight on the wind resource integration services currently purchased by public power customers and offer additional renewable resource shaping services to such customers using wind generation to serve their load.

FY 2011: Continue to provide oversight of all contracts signed to date. Pursue cost-effective means to mitigate capacity demands associated with interconnecting large amounts of wind into the BPA system. Pursue acquisition of additional cost-effective renewable generation to meet load growth. Continue to provide oversight on the wind resource integration services currently purchased by public power customers and offer additional renewable resource shaping services to such customers using wind generation to serve their load.

Associated Project Costs	**295,578**	**323,306**	**334,777**

- Support FCRPS project costs and work to strengthen interagency and regional relationships to improve project performance, supporting functions, and to better understand project resource requirements and costs. This helps to maintain FCRPS reliability and system performance, as well as to attain BPA's strategic business objectives.

- Bureau of Reclamation:
  FY 2009: Continued direct funding Reclamation O&M power activities.
  FY 2010: Continue direct funding Reclamation O&M power activities.
  FY 2011: Continue direct funding Reclamation O&M power activities.

- Corps of Engineers:
  FY 2009: Continued direct funding Corps O&M power activities.
  FY 2010: Continue direct funding Corps O&M power activities.
  FY 2011: Continue direct funding Corps O&M power activities.

Fish and Wildlife	**177,369**	**215,000**	**236,000**

- Specific project solicitation recommendations were made by the Council in late 2006 followed by BPA review and funding decisions completed in early 2007 for the period FY 2007 through 2009. BPA, in coordination with the Council, reviews all on-going projects and reaffirms many project-specific commitments in 2008 through both Biological Opinions and Fish Accords. These decisions were based upon the management objectives and priorities in the Program and Sub-basin Plans as well as an integration of ESA responsibilities as described in the NOAA Fisheries and U.S. Fish and Wildlife Service's FCRPS Biological Opinions. Coordination continues among BPA, Council, Federal resource management agencies, states, tribes and others to plan for additional projects to fill specific gaps in BPA's mitigation portfolio through targeted solicitations.

- Anadromous Fish: Continue implementing both ongoing and new projects that support ESA-listed species and other measures called for under the 2008 FCRPS BiOps and the Fish Accords. Prioritize projects that address the factors that limit mitigation success as identified in the Sub-basin Plans and that fulfill BPA's responsibility for mitigation of the FCRPS. Implement and develop activities that protect and enhance tributary and estuary habitat; improve mainstream habitat on an experimental basis; reduce potentially harmful hatchery practices on ESA-listed populations; and contribute to sustainable fisheries. These activities have been selected in response to the Northwest Power Act section 2(6) to "protect, mitigate and enhance fish and wildlife including related spawning grounds and habitat on the Columbia River and its tributaries."

- Resident Fish: Implement activities to determine the impacts of the FCRPS on lamprey and bull trout and mitigate for those impacts, and promote the reproduction and recruitment of Kootenai River white sturgeon. These activities have been selected in response to the 2006 BiOp, the Fish Accords, and the Northwest Power Act purpose to "protect, mitigate and enhance fish and wildlife including related spawning grounds and habitat on the Columbia River and its tributaries."

- Continue mitigation using resident fish to offset anadromous fish losses (substitution); mitigate for reservoir operation impacts to resident fish; and continue to refine, quantify, and delineate the difference between the two. Those resident fish habitat acquisition projects that meet BPA's Capitalization Policy will be funded under the capital portion of Bonneville's Fish and Wildlife budget.

- Wildlife: Use existing Bonneville policies to continue the current effort to mitigate wildlife in a manner consistent with Council's 2009 Fish and Wildlife Program. These activities have been selected in response to the Northwest Power Act requirement to protect, mitigate and enhance fish and wildlife including related spawning grounds and habitat on the Columbia River and its tributaries. Those wildlife acquisition projects that meet BPA's Capitalization Policy will be funded under the capital portion of Bonneville's Fish and Wildlife budget and credited at a ratio of one unit of credit for every habitat unit lost to a dam.

Residential Exchange Program 205,171 265,558 270,087

- Includes forecasted REP costs for FYs 2009-2011.

Northwest Power and Conservation Council 9,424 9,683 9,934

- Continue support of the Council activities, as directed under the Northwest Power Act, including regional power plan development and maintenance, and fish and wildlife program activities.

Conservation and Energy Efficiency 99,444 140,572 141,386

- Continue close-out of the legacy conservation resource acquisition contracts, which support Bonneville's contractual obligation to serve customer load growth.

- Provide credible, unbiased information, and technical and financial support to conservation purposes. As an agency with independent responsibilities based on its authorizing legislation, Bonneville has a statutory responsibility to encourage and support the development of conservation in the Pacific Northwest. Bonneville is participating with other regional entities to support market transformation and development activities that meet the needs of Bonneville customers and create business opportunities for the private sector in the Pacific Northwest. Toward that end, BPA has been helping create a delivery infrastructure to ensure conservation savings are installed efficiently and effectively throughout the region.

Total, Power Services – Operating Expense 1,709,746 2,287,653 2,489,579

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Production	
▪ Primarily reflects increases in power purchases.	+163,861
Associated Project Costs	
▪ Reflects changes to security, biological opinion requirements, non-routine extraordinary maintenance, WECC/NERC compliance activities, and improvements, replacements, and minor additions at the projects.	+11,471
Fish and Wildlife	
▪ Reflects funding associated with Biological Opinions, Fish Accord commitments and Northwest Power Act activities.	+21,000
Residential Exchange	
▪ Reflects forecast of public exchange costs.	+4,529
Northwest Power and Conservation Council	
▪ Small increase reflects continuing Council program activities.	+251
Conservation and Energy Efficiency	
▪ Small increase reflects normal program adjustments.	+814
Total Funding Change, Power Services - Operating Expense	**+201,926**

Transmission Services - Operating Expense

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Transmission Services - Operating Expense	FY 2009	FY 2010	FY 2011
Engineering	32,678	44,671	49,752
Operations	116,626	145,399	147,583
Maintenance	151,859	151,997	157,350
Total, Transmission Services - Operating Expense	301,163	342,067	354,685

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Transmission Services - Operating Expense	369,407	382,133	393,582	387,219

Description

This activity provides for the transmission system services of engineering, operations, and maintenance for Bonneville's electric transmission system, consisting of over 15,238 circuit miles (24,523 circuit kilometers) of lines, 259 substations, and the associated power system control and communication facilities, with an invested cost of more than $6.0 billion. Primary strategies of this program are: 1) maintain the safety and reliability of the transmission system; 2) increase the focus on meeting customers' needs; 3) optimize the transmission system; and 4) provide open and nondiscriminatory transmission access; and 5) improve Bonneville's cost effectiveness.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Engineering	**32,678**	**44,671**	**49,752**

Continue efforts to identify best methods for improving system reliability and maintenance practices, and continue cost reduction efforts by identifying opportunities for low-cost reinforcement and voltage support of the existing transmission system.

(dollars in thousands)

FY 2009	FY 2010	FY 2011

- Asset Management: Continue deploying the Asset Management approach to sustain the existing assets and expanding the system to meet Agency objectives. Prepare for certification to Publicly Available Specifications (PAS)-55 over three to five years.

- R&D: Conduct research focused on technologies related to business challenges BPA faces including reliability, energy efficiency, and integration of renewable energy resources. Technologies of interest are identified in BPA's Technology Roadmaps. A portfolio of research is selected every year through BPA's Portfolio Decision Framework.

- Technical Support: Provide technical support activities, such as transmission system planning and studies to optimize portions of the system. Provide support for non-wires solutions studies and pilot projects.

- Capital-to-Expense Adjustments: Conduct annual analysis of Bonneville's outstanding capital work orders to assess whether they should be expensed. As obsolete inventory is identified and disposed of, it is expensed.

- Regulatory Fees: Western Electricity Coordinating Council (WECC) dues based on the load of WECC members as a proportion of the total load within the WECC area. Includes membership in Columbia Grid.

- Reimbursable Transactions: Enter into written agreements with Federal and non-Federal entities that have work or services to be performed by Bonneville staff at the expense of the benefiting entities. The projects must be beneficial, under agreed upon criteria, to Bonneville operations and to the Federal or non-Federal entity involved or otherwise be aligned with or supportive of BPA's strategic objectives. Additionally, these activities generally contribute to more efficient or reliable construction of the Federal transmission system or otherwise enhance electric service to the region.

- Leased and Other Costs: Includes leases and other costs of financing transmission, delivery and voltage support facilities when such arrangements are operationally feasible and cost effective to deliver power. Capitalized leases enable BPA to continue to invest in infrastructure to support a safe and reliable system for the transmission of power. Other costs included are the accrued interest costs associated with Large Generator Interconnection Agreements (LGIA).

Operations	**116,626**	**145,399**	**147,583**

- FY 2009: Continued to operate within parameters of regional transmission authorities. Supported new compliance activities related to the reliability of the transmission system including cyber security. Developed facilities, policies, procedures and implementing systems to support the integration of high levels of wind generation into the transmission grid. Prepared for increased complexity of power system operations and dispatching including congestion management and outage scheduling as well as increased complexities in transmission scheduling. Addressed succession planning issues across key functions. Continued development and implementation of business systems and tools.

- FY 2010: Continue to operate within parameters of regional transmission authorities. Continue support of increased compliance activities related to the reliability of the transmission system including cyber security. Continue developing facilities, policies, procedures and implementing systems to support the integration of high levels of wind generation into the transmission grid. Continue preparation for increased complexity of power system operations and dispatching including congestion management and outage scheduling as well as increased complexities in transmission scheduling. Continue to address succession planning issues across key functions. Continue development and implementation of business systems and tools.

- FY 2011: Continue to operate within parameters of regional transmission authorities. Continue support of compliance activities related to the reliability of the transmission system including cyber security. Further expand facilities and refine policies and procedures and implementing systems to support the integration of high levels of wind generation into the transmission grid. Continue preparation for increased complexity of power system operations and dispatching including congestion management and outage scheduling as well as increased complexities in transmission scheduling. Continue to address succession planning issues across key functions. Continue development and implementation of business systems and tools.

- Substation Operations: Perform operations functions necessary to provide electric service to customers and to protect the Federal investment in electric equipment and other facilities. Includes equipment adjustments, switching lines and equipment during emergencies or maintenance, isolating damaged equipment, restoring service to customers, and inspecting equipment, reading meters, etcetera.

- Power System Dispatching and Supporting Functions: Perform central dispatching, control, and monitoring of the electric operation of the Federal transmission system. Also includes load, frequency and voltage control of Federal generating plants, and coordinating long and short term outages of system equipment. In addition, provides technical engineering support of dispatching function and provides all technical and systems support for Dittmer Control Center (DCC) and Munro Control Center (MCC) power system control centers.

- Marketing and Sales: Provide management and direction of transmission rates, and provide business strategy in marketing of transmission and ancillary products and services of Transmission Services. Involve customers and constituents in the process of product and rate development. Maintain accurate and complete historical records of current and past transmission agreements. Provide guidance for current and future transmission contract negotiations. Provide financial analysis of market strategies. Monitor and report on the financial health of Transmission Services. Support cost management by effective reporting and analysis of current expenditures. Ensure official budget submittals reflect current management financial strategies and adequately fund transmission programs.

- Transmission Scheduling: Provide open access to the Federal transmission system consistent with the Open Access Transmission Tariff. Schedule and market transmission capacity to Bonneville customers. Manage the reservations and scheduling of all transmission services associated with the Open Access Transmission Tariff. Update practices, policies and systems to accommodate large amounts of wind generation.

Maintenance	**151,859**	**151,997**	**157,350**

In all aspects of maintenance, Bonneville is continuing the use of Reliability Centered Maintenance (RCM) practices. The use of RCM practices is focused on improving system reliability, increasing availability and meeting new and existing compliance regulations. In addition BPA is deploying Asset Management to optimize maintain/replace decision making. Maintenance costs are expected to increase as Bonneville addresses the aging transmission system, meeting Reliability Standards including Vegetation Management, and environmental constraints associated with construction, enhancement, and maintenance of the system. The Bonneville transmission system encompasses 15,238 circuit miles on over 8,500 right-of-way miles (many of these miles are through rugged, inaccessible terrain).

- FY 2009: Continued to refine RCM practices in all of Bonneville's O&M regions. Implemented processes for monitoring and tracking compliance activities related to the reliability of the transmission system. Continued to improve performance meeting System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) targets. Continued efforts to achieve the SAIFI and SAIDI targets of no control chart violations for circuit importance categories 1-2 (highest importance), and not more than one violation for category 4. Control charts are statistically based graphs that illustrate variability in performance. Continued to improve availability performance by utilizing more efficient and cost-effective maintenance work practices and outage coordination. Used recruitment incentives to ensure succession of the current work force and remain competitive as an employer in the utility industry. Assured a safe work environment through safety awareness and improved work practices. Increased outage scheduling planning to increase customer satisfaction. Continued high levels of vegetation management and increased access road work to provide reliable access to facilities and ensure environmental compliance. Deployed new technologies such as Light Detection and Ranging (LiDAR) to reliably and cost effectively manage vegetation.

- FY 2010: Continue to refine RCM practices and deploy asset management in all of Bonneville's O&M districts. Continue refining processes and procedures for monitoring and tracking compliance activities related to the reliability of the transmission system. Continue to improve performance to meet SAIFI and SAIDI targets as explained above. Continue to improve system availability performance through new maintenance procedures and work practices. Develop work practices and procedures for implementation of a new specialty crew using bare-handing practices for maintenance of high-voltage transmission lines. Continue increased emphasis on replacement of line hardware (life extension programs for insulators, connectors, dampers & fiber optic cable hardware). Continue to prepare for the impact of an expected high attrition rate among Bonneville's aging workforce by recruiting apprentices and replacements for critical minimum crew size workload positions. Increase outage scheduling and coordination planning to increase customer satisfaction and system availability. Increase emphasis on non-electric facilities to compensate for years of deferral. Continue high emphasis of vegetation management, implementation of an aggressive access road management plan to maintain roads at a level that minimizes response time, increases reliability, and ensures environmental compliance. Continue improving environmental stewardship.

- FY 2011: Continue to improve performance to meet SAIFI and SAIDI targets as explained above. Continue refining processes and procedures for monitoring and tracking compliance activities related to the reliability of the transmission system. Continue to improve system availability performance through new maintenance procedures and work practices. Continue to develop and implement work practices and procedures for implementation of a new specialty crew using bare-handing practices for maintenance of high-voltage transmission lines. Continue increased emphasis on replacement of line hardware (life extension programs for insulators, connectors, dampers & fiber optic cable hardware). Continue to prepare for the impact of an expected high attrition rate among Bonneville's aging workforce by recruiting apprentices and replacements for critical minimum crew size workload positions. Increase outage-scheduling planning and coordination to increase customer satisfaction and system availability. Maintain vegetation management levels to ensure system reliability. Continue access road work to provide reliable access to facilities and ensure environmental compliance. Continue improving environmental stewardship.

- Transmission Line Maintenance: Maintain and repair 15,238 circuit miles (24,523 km) of high voltage transmission lines, of which over 7,617 km (4,734 circuit miles) are 500-kV transmission EHV (extra-high voltage), for which maintenance is two and one-half times more labor-intensive than maintenance of lower transmission voltages, although more efficient in transmission of power. This responsibility includes maintaining transmission rights-of-way to ensure system reliability, safety, and environmental compliance. Adopt work practices that improve system availability, reliability, and compliance.

- Right-of-Way Maintenance: Maintain and manage vegetation from over 8,500 of Bonneville's right-of-way miles. This responsibility includes vegetation management, danger tree management, and access road maintenance to ensure system reliability, safety, and environmental compliance. Adopt procedures and processes that improve system availability, reliability, environmental compliance, and reliability compliance. Continue to deploy new technologies such as LiDAR to reliably and cost effectively manage vegetation.

- Substation Maintenance: Maintain and repair the transmission system power equipment located in Bonneville's 259 substations. Work includes inspections, diagnostic testing and predictive and condition based maintenance.

- System Protection Maintenance: Maintain relaying metering and remedial action scheme equipment used to control and protect the electrical transmission system and to meter energy transfers for the purpose of revenue billing. Additionally, field-engineering services provide technical advice and assure the correct operation of power system relaying and special control systems used to support interregional energy transmission capabilities.

- Power System Control Maintenance: Test, repair, and provide field engineering support of Bonneville's highly complex equipment, communications, and control systems, including seven major microwave systems, fiber optic systems, and other critical communications and control equipment that support the power system.

- Non-Electric Plant Maintenance: Maintain and manage Bonneville's non-electric facilities. Includes site, building, and building utility maintenance; custodial services; station utility; and other maintenance service activities, as well as, facilities asset management on Bonneville-owned or Bonneville-leased non-electric facilities.

- Maintenance Standards and Engineering: Establish, monitor, and update system maintenance standards, policies, and procedures, and review and update long-range plans for maintenance of the electric power transmission system.

Total, Transmission Services - Operating Expense	**301,163**	**342,067**	**354,685**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Engineering	
▪ Reflects emphasis on system reliability improvements, research and development, and an increase in lease payments.	+5,081
Operations	
▪ Reflects continued emphasis on reliability compliance activities, wind integration activities, security, and control center systems support.	+2,184
Maintenance	
▪ Primarily reflects implementation of the facilities asset management plans, implementation of a new bare-handing crew, NERC/WECC compliance activities related to land rights and vegetation management, continuing maintenance program activities, including system protection, right-of-way, line maintenance, and performance improvements.	+5,353
Total Funding Change, Transmission Services – Operating Expense.	**+ 12,618**

Interest, Pension and Post-retirement Benefits - Operating Expense and Capital Transfers

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Interest, Pension and Post-retirement Benefits	FY 2009	FY 2010	FY 2011
BPA Bond Interest (Net)	113,333	66,827	106,536
BPA Appropriation Interest	35,356	32,979	27,538
Corps of Engineers Appropriation Interest	158,025	163,461	150,195
Lower Snake River Comp Plan Interest	16,450	16,450	16,450
Bureau of Reclamation Appropriation Interest	43,367	43,367	43,306
Subtotal, Interest – Operating Expense	366,531	323,084	344,025
Pension and Post-retirement Benefits	32,706	30,894	31,157
Total, Interest, Pension and Post-retirement Benefits	399,237	353,978	375,182

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Interest, Pension and Post-retirement Benefits	415,944	461,942	509,327	550,510

Operating Expense

Description

Interest expense provides for the payment of interest due on Federal debt. This consists of capital investment in FCRPS hydroelectric generating and transmission facilities of Bonneville, the Corps and Reclamation. Investments were financed by Congressional appropriations and Bonneville borrowings from the Treasury. Bonneville repays Federal debt through its power sales and transmission services revenues.

Since receiving Treasury borrowing authority in 1974 under the Transmission System Act, all Bonneville borrowing has been at market rates. As of Oct 1, 1996, all of Bonneville's repayment obligations on FCRPS appropriated investment (Corps and Reclamation FCRPS investment and Bonneville investment) financed with appropriations prior to the Transmission System Act that were unpaid as of Sept 30, 1996, were restructured and assigned new current-market interest rates. The Bonneville Appropriations Refinancing Act of 1996 called for resetting (reducing) the unpaid principal of FCRPS appropriations and reassigning (increasing) interest rates. New principal amounts were established as of the beginning of FY 1997 at the present value of the principal and annual interest payments Bonneville would make to the Treasury for these obligations in the absence of the legislation, plus $100 million. The new principal amounts were assigned new interest rates based on the Treasury yield curve rates prevailing at the end of FY 1996. Bonneville's outstanding repayment obligations on appropriations at the end of FY 1996 were $6.7 billion with a weighted average interest rate of 3.4 percent. The refinancing reduced the principal amount to $4.1 billion with a weighted average interest rate of 7.1 percent. Implementation of the refinancing took place in 1997 after audited actual financial data was available. As called for in the legislation, Bonneville submitted its calculations and interest rate assignments implementing the Bonneville Appropriations Refinancing Act to Treasury for their review and approval. Treasury approved the implementation calculations in July 1997. The Act also calls for all future FCRPS appropriations to be assigned prevailing Treasury yield curve interest rates.

Interest estimates are a direct function of costs of Treasury borrowing to Bonneville, repayment status of outstanding FCRPS investments, and projected additions to FCRPS plant in service. These estimates may change over time depending on forecasted market conditions. The interest cost estimates include the impact of Bonneville's appropriation refinancing legislation.

Bonneville has been paying its unfunded liability of the Civil Service Retirement System (CSRS) and post-retirement benefits into the General Fund of the Treasury (receipt account 892889) since FY 1998. These payments are consistent with the FY 2001 Administration's budget which assumed Bonneville would prospectively cover the full unfunded liability that accrues in fiscal years after FY 1997 of the Civil Service Retirement and Disability Fund (Disability Fund), the Employees Health Benefits Fund (Health Fund), and the Employees Life Insurance Fund (Insurance Fund) that it had not covered prior to FY 1998. Cost estimates include pension and post-retirement benefits for Bonneville and the power-related portion of the Corps, Reclamation, and USFWS.

Capital Transfers

Funding Schedule by Activity

(accrued expenditures)
(dollars in thousands)

Capital Transfers	FY 2009	FY 2010	FY 2011
BPA Bond Amortization /1	393,460	140,319	160,000
Reclamation Appropriation Amortization	0	850	0
BPA Appropriation Amortization	9,889	74,905	124,707
Corps Appropriation Amortization	28,670	243,755	102,163
Total, Capital Transfers	432,019	459,829	386,870

Outyear Funding Schedule

(accrued expenditures)
(dollars in thousands)

	FY 2012	FY 2013	FY 2014	FY 2015
Total, Capital Transfers	332,261	197,364	150,700	90,958

/1 BPA "Bond(s)" in this FY 2011 budget refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines BPA bonds as all bonds, notes, and other evidences of indebtednesses issued and sold to the U.S. Treasury.

Description

This activity conveys funds to the Treasury for repayment of certain FCRPS costs not included in the Associated Project Costs budget. Since capital transfers are cash transactions, they are not considered budget obligations.

BONNEVILLE POWER ADMINISTRATION
TOTAL OBLIGATIONS/OUTLAYS
Current Services
(in millions of dollars)
FISCAL YEAR

FB 25-Jan-10

BP-1 SUMMARY	2009		2010		2011		2012	2013	2014	2015
1,3/	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Oblig.	Oblig.	Oblig.
1 Residential Exchange Program	205	205	266	266	270	270	219	219	219	227
2 Power Services 2/	1,219	1,219	1,658	1,658	1,832	1,832	1,910	2,030	2,048	2,069
3 Transmission Services	494	494	792	792	817	817	896	820	789	816
4 Conservation & Energy Efficiency	117	117	174	174	181	181	226	228	229	225
5 Fish & Wildlife	205	205	285	285	296	296	292	298	304	312
6 Interest/ Pension 4/	399	399	354	354	375	375	416	462	509	551
7 Associated Project Cost - Capital	140	140	159	159	172	172	180	191	192	196
8 Capital Equipment	31	31	24	24	22	22	27	27	28	30
3 Planning Council	9	9	10	10	10	10	10	10	10	11
10 Misc. Accounting Adjs.	0	0	0	0	0	0	0	0	0	0
11 Projects Funded in Advance	184	184	77	77	77	77	78	78	78	59
12 Capitalized Bond Premiums	0	0	0	0	2	2	2	2	2	0
13 Misc. Accounting Adjs.	0	0	0	0	0	0	0	0	0	0
TOTAL OBLIGATIONS/ OUTLAYS 3/	**3,003**	**3,003**	**3,799**	**3,799**	**4,054**	**4,054**	**4,256**	**4,365**	**4,408**	**4,496**

REVENUES AND REIMBURSEMENTS

Current Services
(in millions of dollars)
FISCAL YEAR

BP-1 SUMMARY	2009		2010		2011		2012	2013	2014	2015
	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Oblig.	Oblig.	Oblig.
13 Revenues 5/	2,704	2,704	3,806	3,809	4,111	4,111	4,188	4,297	4,339	4,447
14 Project Funded in Advance	184	184	77	77	77	77	78	78	78	59
15 **TOTAL**	**2,888**	**2,888**	**3,883**	**3,886**	**4,188**	**4,188**	**4,266**	**4,375**	**4,417**	**4,506**
BUDGET AUTHORITY (NET) 6/	**579**		**276**		**371**		**501**	**559**	**584**	**662**
16 **OUTLAYS (NET) 6,7/**		**234**		**(10)**		**(10)**	**(10)**	**(10)**	**(10)**	**(10)**

The accompanying notes are an integral part of this table.

1/ This FY 2011 budget includes capital and expense estimates based on IPR 2 forecasted data for FYs 2010-2015 and consistent with estimates from the 2010 final transmission and power rate cases.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

2/ Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

3/ This budget has been prepared in accordance with the Budget Enforcement Act (BEA) of 1990. Under this Act all BPA budget estimates are treated as mandatory and are not subject to the discretionary caps included in the BEA. These estimates support activities which are legally separate from discretionary activities and accounts. Thus, any changes to BPA estimates cannot be used to affect any other budget categories which have their own legal dollar caps. Because BPA operates within existing legislative authority, BPA is not subject to a Budget Enforcement "pay-as-you-go" test regarding its revision of current-law funding estimates.

4/ See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

5/ Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the NW Power Act are also assumed.

6/ BPA received $49 million of additional budget authority in FY 2007 to accommodate the work necessary to relocate the radio spectrum consistent with the Commercial Spectrum Enhancement Act (P.L. 108-494). In subsequent years, per the assumed expenditures developed as part of BPA's work plans, outlays for the work performed are assumed.

7/ Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Estimated Net Outlays could change due to changing market conditions, streamflow variability, and ongoing changes in the electric industry.

EXPENSED OBLIGATIONS/OUTLAYS 1,4/
Current Services
(in millions of dollars)
FISCAL YEAR

BP-2	2009		2010		2011		2012	2013	2014	2015
	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Oblig.	Oblig.	Oblig.
1 Residential Exchange Program	205	205	266	266	270	270	219	219	219	227
2 Power Services 2/	1,218	1,218	1,657	1,657	1,832	1,832	1,910	2,030	2,048	2,069
3 Transmission Services	301	301	342	342	355	355	369	382	394	387
4 Conservation & Energy Efficiency	99	99	141	141	141	141	178	180	181	177
5 Fish & Wildlife	177	177	215	215	236	236	242	248	254	262
6 Interest/ Pension 3/	399	399	354	354	375	375	416	462	509	551
7 Planning Council	9	9	10	10	10	10	10	10	10	11
8 TOTAL EXPENSE	2,408	2408	2985	2985	3219	3219	3344	3531	3615	3684

10 Projects Funded in Advance	184	184	77	77	77	77	78	78	78	59

CAPITAL OBLIGATIONS/OUTLAYS
Current Services
(in millions of dollars)
FISCAL YEAR

BP-2 continued	2009		2010		2011		2012	2013	2014	2015
	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Outlays	Oblig.	Oblig.	Oblig.	Oblig.
Conservation & Energy Efficiency	18	18	33	33	40	40	48	48	48	48
11 Transmission Services	193	193	450	450	462	462	527	438	395	429
12 Associated Project Cost	140	140	159	159	172	172	180	191	192	196
13 Fish & Wildlife	28	28	70	70	60	60	50	50	50	50
14 Capital Equipment	31	31	24	24	22	22	27	27	28	30
15 Capitalized Bond Premiums	0	0	0	0	2	2	2	2	2	0
16 TOTAL CAPITAL INVESTMENTS \5	**410**	**410**	**736**	**736**	**758**	**758**	**834**	**756**	**715**	**753**
17 TREASURY BORROWING AUTHORITY TO FINANCE CAPITAL OBLIGATIONS 4/	**385**		**736**		**758**		**834**	**756**	**715**	**753**

The accompanying notes are an integral part of this table.

1/ This FY 2011 budget includes capital and expense estimates based on IPR 2 forecasted data for FYs 2010-2015 and consistent with estimates from the 2010 final transmission and power rate cases.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

2/ Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

3/ See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

4/ This budget has been prepared in accordance with the Budget Enforcement Act (BEA) of 1990. Under this Act all BPA budget estimates are treated as mandatory and are not subject to the discretionary caps included in the BEA. These estimates support activities which are legally separate from discretionary activities and accounts. Thus, any changes to BPA estimates cannot be used to affect any other budget categories which have their own legal dollar caps. Because BPA operates within existing legislative authority, BPA is not subject to a Budget Enforcement "pay-as-you-go" test regarding its revision of current-law funding estimates.

BP-3

CURRENT SERVICES
(in millions of dollars)

FISCAL YEAR

	CAPITAL TRANSFERS	2009 Pymts	2010 Pymts	2011 Pymts	2012 Pymts	2013 Pymts	2014 Pymts	2015 Pymts
	Amortization:							
20	BPA Bonds	393	140	160	118	10	47	70
21	Reclamation Appropriations	0	1	0	0	44	0	0
22	BPA Appropriations	10	75	125	168	66	22	0
23	Corps Appropriations	29	244	102	47	77	81	21
24	**TOTAL CAPITAL TRANSFERS**	**432**	**460**	**387**	**333**	**197**	**150**	**91**

STAFFING

		2009	2010	2011	2012	2013	2014	2015
25	**FULL-TIME EQUIVALENT (FTE)**	**3,021**	**3,100**	**3,100**	**3,100**	**3,100**	**3,100**	**3,100**

The accompanying notes are an integral part of this table.

The cumulative amount of actual advance amortization payments as of the end of FY 2009 is $2,536 million.

PROGRAM & FINANCING SUMMARY

Current Services

(in millions of dollars)

Identification Code: 89-4045-0-3-271

	2009	2010	2011	2012	2013	2014	2015
Program by activities:							
Operating expenses:							
0.01 Power Services	923	1,335	1,498	1,556	1,666	1,675	1,683
0.02 Residential Exchange Program	205	266	270	219	219	219	227
Associated Project Costs:							
0.05 Bureau of Reclamation	78	87	96	105	107	110	114
0.06 Corps of Engineers	178	191	192	201	207	213	220
0.07 Colville Settlement	18	21	22	22	23	23	24
0.19 U.S. Fish & Wildlife Service	21	24	24	26	27	27	28
0.20 Planning Council	9	10	10	10	10	10	11
0.21 Fish & Wildlife	177	215	236	242	248	254	262
0.23 Transmission Services	301	342	355	369	382	394	387
0.24 Conservation & Energy Efficiency	99	141	141	178	180	181	177
0.25 Interest	367	323	344	384	429	475	515
0.26 Pension and Health Benefits 1/	33	31	31	32	33	34	35
0.91 **Total operating expenses 2/**	**2,409**	**2,986**	**3,219**	**3,344**	**3,531**	**3,615**	**3,683**
Capital investment:							
1.01 Power Services	140	159	172	180	191	192	196
1.02 Transmission Services	193	450	462	527	438	395	429
1.03 Conservation & Energy Efficiency	18	33	40	48	48	48	48
1.04 Fish & Wildlife	28	70	60	50	50	50	50
1.05 Capital Equipment	31	24	22	27	27	28	30
1.06 Capitalized Bond Premiums	0	0	2	2	2	2	0
1.07 **Total Capital Investment 3/**	**410**	**736**	**758**	**834**	**756**	**715**	**753**
1.08 Misc. Accounting Adjustments							
2.01 Projects Funded in Advanced	184	77	77	78	78	78	59
10.00 **Total obligations 4/**	**3,003**	**3,799**	**4,054**	**4,256**	**4,365**	**4,408**	**4,495**

The accompanying notes are an integral part of this table.

1/ See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

2/ Assumes expense obligations, not accrued expenses.
Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

3/ Assumes capital obligations, not capital expenditures.

4/ This FY 2011 budget includes capital and expense estimates based on IPR 2 forecasted data for FYs 2010-2015 and consistent with estimates from the 2010 final transmission and power rate cases.

For purposes of this table, this FY 2011 budget reflects, for FY 2009, actual third party financing expense only for PFIA.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

Refer to 16 USC Chapters 12B, 12G, 12H, and BPA's other organic laws, including P.L. 100-371, Title III, Sec. 300, 102 Stat. 869, July 18, 1988 regarding BPA's ability to obligate funds.

Program and Financing (continued)

Current Services
(in millions of dollars)

	2009	2010	2011	2012	2013	2014	2015
Financing:							
21.90 Unobligated balance available, start of year. 5/	38	26	15	2	0	0	0
24.40 Unobligated balance available, end of year.5/	26	15	2	0	0	0	0
39.00 Budget authority (gross)	**3,431**	**4,159**	**4,559**	**4,767**	**4,934**	**4,981**	**5,168**
Budget Authority:							
67.10 Permanent Authority: Authority to borrow from Treasury (indefinite) 6/	385	736	758	834	756	714	753
Spending authority from off-setting collections	2,888	3,883	4,188	4,266	4,375	4,417	4,506
69.47 Portion applied to debt reduction	(440)	(460)	(367)	(333)	(197)	(150)	(91)
69.90 Spending authority from offsetting collections (adjusted)	**2,337**	**3,423**	**3,801**	**3,933**	**4,178**	**4,267**	**4,415**
71.00 Total obligations	3,003	3,799	4,054	4,256	4,365	4,408	4,495
87.00 Outlays (gross)	3,122	3,799	4,054	4,256	4,365	4,408	4,495
Adjustments to budget authority and outlays: Deductions for offsetting collections:							
88.00 Federal funds	(30)	(90)	(90)	(90)	(90)	(90)	(90)
88.40 Non-Federal sources	(2,860)	(3,796)	(4,102)	(4,176)	(4,285)	(4,327)	(4,416)
88.90 Total, offsetting collections	(2,888)	(3,886)	(4,192)	(4,266)	(4,375)	(4,417)	(4,506)
89.00 Budget authority (net)	**579**	**276**	**371**	**501**	**559**	**584**	**662**
90.00 Outlays (net) 7/	**234**	**(10)**	**(10)**	**(10)**	**(10)**	**(10)**	**(10)**

The accompanying notes are an integral part of this table.

5/ Reflects estimated cost for radio spectrum fund.

6/ The Permanent Authority: Authority to borrow (indefinite) from Treasury amounts reflect both BPA's capital program financing needs and either the use of, or creation of, deferred borrowing. Deferred borrowing in created when, as a cash and debt management decision, BPA uses cash from revenues to liquidate capital obligations in lieu of borrowing from Treasury. This temporary use of cash on hand instead of borrowed funds creates the ability in future years to borrow money, when fiscally prudent.
The FY 1989 Energy and Water Development Appropriations Act (P.L. 100-371, 7/19/88, 102 Stat. 869) clarified that BPA has authority to incur obligations in excess of Treasury borrowing authority and cash in the BPA fund.

7/ Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Estimated Net Outlays could change due to chenging market conditions, streamflow variability, and ongoing chenges in the electric industry.

Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the NW Power Act are also assumed.

This budget has been prepared in accordance with the Budget Enforcement Act (BEA) of 1990. Under this Act all BPA budget estimates are treated as mendatory and are not subject to the discretionary caps included in the BEA. These estimates support activities which are legally separate from discretionary activities and accounts. Thus, any changes to BPA estimates cannot be used to affect any other budget categories which have their own legal dollar caps. Because BPA operates within existing legislative authority, BPA is not subject to a Budget Enforcement "pay-as-you-go" test regarding its revision of current-law funding estimates.

BONNEVILLE POWER ADMINISTRATION
BPA STATUS of TREASURY BORROWING
CURRENT SERVICES
(in millions of dollars)

BP-4A

Fiscal Year

	2009				2010			
	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing
Start-of-Year: Total	1,511	1,317	2,410	2,186	1,526	1,332	2,425	2,130
Plus: Annual Increase								
Cum.-Annual Treasury Borrowing	409	409	409		736	736	736	
Treasury Borrowing (Cash)				338				736
Less:								
BPA Bond Amortization	394	394	394	394	140	140	140	140
Net Increase/(Decrease):	15	15	15	(56)	596	596	596	596
Cum.-End-of-Year: Total	1,526	1,332	2,425	2,130	2,122	1,928	3,021	2,726
Total Remaining Treasury Borrowing Amount				5,570				4,974
Total Legislated Treasury Borrowing Amount				7,700				7,700

The accompanying notes are an integral part of this table.

In any given year, BPA may issue less debt than forecast depending on net revenues, Treasury interests rates, and other cash management factors. In such cases, BPA accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2011 budget, BPA "bond(s)" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines "bonds" as all bonds, notes, and other evidences of indebtednesses issued and sold by BPA to the U.S. Treasury.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

BPA reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2009-2015.

The cumulative amount of actual advance amortization payments as of the end of FY 2009 is $2,536 million.

BONNEVILLE POWER ADMINISTRATION
BPA STATUS of TREASURY BORROWING
CURRENT SERVICES

(in millions of dollars)

BP-4B

Fiscal Year

	2011				2012			
	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing
Start-of-Year: Total	2,122	1,928	3,021	2,726	2,721	2,527	3,620	3,325
Plus: Annual Increase								
Cum.-Annual Treasury Borrowing	759	759	759		834	834	834	
Treasury Borrowing (Cash)				759				834
Less:								
Total BPA Bond Amortization	160	160	160	160	118	118	118	118
Net Increase/(Decrease):								
Total	599	599	599	599	716	716	716	716
Cum.-End-of-Year: Total	2,721	2,527	3,620	3,325	3,437	3,243	4,336	4,041
Total Remaining Treasury Borrowing Amount				4,375				3,659
Total Legislated Treasury Borrowing Amount				7,700				7,700

The accompanying notes are an integral part of this table.
In any given year, BPA may issue less debt than forecast depending on net revenues, Treasury interests rates, and other cash management factors. In such cases, BPA accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2011 budget, BPA "bond(s)" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines "bonds" as all bonds, notes, and other evidences of indebtednesses issued and sold by BPA to the U.S. Treasury.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

BPA reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2009-2015.

BONNEVILLE POWER ADMINISTRATION
BPA STATUS of TREASURY BORROWING
CURRENT SERVICES

(in millions of dollars)

BP-4C

Fiscal Year

	2013				2014			
	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing
Start-of-Year: Total	3,437	3,243	4,336	4,041	4,182	3,988	5,081	4,786
Plus: Annual Increase								
Cum.-Annual Treasury Borrowing	755	755	755		714	714	714	
Treasury Borrowing (Cash)				755				714
Less:								
Total BPA Bond Amortization	10	10	10	10	47	47	47	47
Net Increase/(Decrease):								
Total	745	745	745	745	667	667	667	667
Cum.-End-of-Year: Total	4,182	3,988	5,081	4,786	4,849	4,655	5,748	5,453
Total Remaining Treasury Borrowing Amount				2,914				2,247
Total Legislated Treasury Borrowing Amount				7,700				7,700

The accompanying notes are an integral part of this table.

In any given year, BPA may issue less debt than forecast depending on net revenues, Treasury interests rates, and other cash management factors. In such cases, BPA accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2011 budget, BPA "bond(s)" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines "bonds" as all bonds, notes, and other evidences of indebtednesses issued and sold by BPA to the U.S. Treasury.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

BPA reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2009-2015.

BONNEVILLE POWER ADMINISTRATION
BPA STATUS of TREASURY BORROWING
CURRENT SERVICES
(in millions of dollars)

BP-4D

	Fiscal Year 2015			
	Net Capital Obs	Net Capital Obs Subject to BA	Net Capital Expend.	Bonds Out-Standing
Start-of-Year: Total	4,849	4,655	5,748	5,453
Plus: Annual Increase				
Cum.-Annual Treasury Borrowing	753	753	753	
Treasury Borrowing (Cash)				753
Less:				
Total BPA Bond Amortization	70	70	70	70
Net Increase/(Decrease):				
Total	683	683	683	683
Cum.-End-of-Year: Total	5,532	5,338	6,431	6,136
Total Remaining Treasury Borrowing Amount				1,564
Total Legislated Treasury Borrowing Amount				7,700

The accompanying notes are an integral part of this table.

In any given year, BPA may issue less debt than forecast depending on net revenues, Treasury interests rates, and other cash management factors. In such cases, BPA accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2011 budget, BPA "bond(s)" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines "bonds" as all bonds, notes, and other evidences of indebtednesses issued and sold by BPA to the U.S. Treasury.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving competitive electric utility industry.

BPA reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2009-2015.

BONNEVILLE POWER ADMINISTRATION
POTENTIAL THIRD PARTY FINANCING TRANSPARENCY

(in millions of dollars)

BP-5

		Fiscal Year						
Transmission Services - Capital		**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Main Grid	Requirements	15	180	194	328	237	196	180
Area & Customer Services		8	32	6	7	8	19	15
Upgrades & Additions		17	97	115	72	61	65	63
System Replacements		121	142	147	120	131	115	171
Projects Funded in Advance		184	77	77	78	78	78	59
Total, Transmission Services - Capital		**345**	**528**	**539**	**605**	**515**	**473**	**488**
Federal and Non-Federal Funding								
Projects Funded in Advance	Sources	184	77	77	78	78	78	59
Treasury Borrowing Authority		161	451	462	527	437	395	429
Scenario								
Third Party Financing	Scenario	120	33	33	101	66	50	52
Alternate Treasury Borrowing Authority		NA	418	429	426	371	345	377

The accompanying notes are an integral part of this table.
The table above shows both the potential use of Treasury borrowing authority for transmission capital projects based on this FY 2011 budget and the use adjusted for potential third-party financing to fund appropriate capital expenditures when feasible in lieu of Treasury borrowing. Estimates included in this FY 2011 budget are uncertain and may change due to revised capital investment plans, access to capital strategic decisions, changing economic conditions, and an evolving financial market environment. The estimates of third-party financing included in the table show a reduction in the use of Treasury borrowing and do not reflect the actual notional third party financing commitment BPA may enter into in that particular year. The difference of reduction in use of Treasury borrowing and the actual notional third party financing commitment is primarily due to the difference in the timing of financing transactions between Treasury and third-party financing for capital projects with multi-year construction schedules.

Bonneville's Third Party Financing for Transmission Services consists primarily of lease-purchase agreements, which are capitalized leases that enable BPA to acquire the use of transmission facilities over time. BPA also undertakes the construction and installation of facilities from funds that customers advance to BPA for construction of BPA-owned facilities that assist the customers in obtaining necessary transmission service from BPA. These customers receive monetary payment credits in bills for transmission services from BPA up to the amount of funds advanced to BPA, plus interest.

BPA's historical Third Party Financing amounts may vary over time due to re-assignment of certain lease-purchase agreements to Treasury Financing.

BPA Status of Treasury Borrowing with Potential Third Party Financing Scenario

With the potential use of third party financing assumed in the scenario above, BPA's total remaining Treasury Borrowing Amount would be extended to the following amounts. See BP-4 BPA Status of Treasury Borrowing- Current Services.

	Fiscal Year						
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Start-of-Year: Total Bonds Outstanding	2,186	2,130	2,693	3,259	3,874	4,553	5,170
Plus:							
Treasury Borrowing (Cash)	338	736	759	834	755	714	753
Less:							
Potential Third Party Financing	NA	33	33	101	66	50	52
BPA Bond Amortization	394	140	160	118	10	47	70
Net Increase/(Decrease) Bonds Outstanding:	(56)	563	566	615	679	617	631
Cum.-End-of-Year: Total	2,130	2,693	3,259	3,874	4,553	5,170	5,801
Total Remaining Treasury Borrowing Amount	5,570	5,007	4,441	3,826	3,147	2,530	1,899
Total Legislated Treasury Borrowing Amount	7,700	7,700	7,700	7,700	7,700	7,700	7,700

TREASURY PAYMENTS

(in millions of dollars)

		FISCAL YEAR						
		2009	2010	2011	2012	2013	2014	2015
A.	**INTEREST ON BONDS & APPROPRIATIONS**							
	Bonneville Bond Interest							
1	Bonneville Bond Interest (net)	91	67	107	157	214	263	306
2	AFUDC [1/]	23	21	23	25	20	16	16
	Appropriations Interest							
3	Bonneville	35	33	28	19	6	2	0
4	Corps of Engineers [2/]	158	163	150	148	149	155	153
5	Lower Snake River	16	16	16	16	16	16	16
6	Bureau of Reclamation [3/]	43	43	43	43	43	40	40
7	**Total Bond and Approp. Interest**	**366**	**343**	**367**	**408**	**448**	**492**	**531**
B.	**ASSOCIATED PROJECT COST**							
8	Bureau of Reclamation Irrigation Assistance	7	0	0	1	60	54	122
9	Bureau of Rec. O & M [4/]	1	0	0	0	0	0	0
10	Corps of Eng. O & M [4/]	6	0	0	0	0	0	0
11	L. Snake River Comp. Plan O & M [4/]	0	0	0	0	0	0	0
12	**Total Assoc. Project Costs**	**14**	**0**	**0**	**1**	**60**	**54**	**122**
C.	**CAPITAL TRANSFERS**							
	Amortization							
13	Bonneville Bonds [6/]	393	140	160	118	10	47	70
14	Bureau of Reclamation Appropriations	0	1	0	0	44	0	0
15	Corps of Engineers Appropriations	29	244	102	47	77	81	21
16	Lower Snake River Comp. Plan	0	0	0	0	0	0	0
17	Bonneville Appropriations	10	75	125	168	66	22	0
	Total Capital Transfers	**432**	**460**	**387**	**333**	**197**	**150**	**91**
D.	**OTHER PAYMENTS**							
18	Unfunded CSRS Liability [5/]	33	31	31	32	33	34	35
21	**TOTAL TREASURY PAYMENTS**	**845**	**834**	**785**	**774**	**738**	**730**	**779**

The accompanying notes are an integral part of this table.

[1/] This interest cost is capitalized and included in BPA's Transmission System Development, System Replacments, and Associated Projects Capital programs. AFUDC is financed through the sale of bonds.

[2/] Includes interest on construction funding for Corp of Engineers (Corps) fish bypass facilities at Corps dams in the Columbia River Basin, including Lower Monumental, Ice Harbor, and The Dalles.

[3/] Includes payments paid by Reclamation to Treasury on behalf of Bonneville.

[4/] Costs for power O&M is funded directly by Bonneville as follows (in millions)

FISCAL YEAR	2009	2010	2011	2012	2013	2014	2015
Bureau of Reclamation	78	87	96	105	107	110	114
Corps of Engineers	178	191	192	201	207	213	220
Subtotal Bureau and Corps	256	278	288	306	314	323	334
Lower Snake River Comp. Plan	21	24	24	26	27	27	28
Total	277	302	312	332	341	350	362

[5/] See Interest Expense, Pension and Post-retirament Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

[6/] In this FY 2011 budget, BPA "bond(s)" refers to all bonds issued by BPA to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act (PL Law 93-454), which defines "bonds" as all bonds, notes, and other evidences of indebtednesses issued and sold by BPA to the U.S. Treasury.

Does not include Treasury bond premiums on refinanced Treasury bonds.

OBJECT CLASSIFICATION STATEMENT

(in millions of dollars) 1/

IDENTIFICATION CODE: 89-4045-0-3-271
DIRECT OBLIGATIONS

		ESTIMATES		
		2009	2010	2011
11.1	Full-time permanent	209	298	312
11.3	Other than full-time permanent	44	71	75
11.5	Other personnel compensation	10	10	11
11.9	**Total personnel compensation**	**263**	**379**	**398**
12.1	Civilian personnel benefits	16	29	31
13.0	Benefits for former personnel	26	31	32
21.0	Travel and transportation of persons	14	20	20
22.0	Transportation of things	1	2	2
23.1	Rental payments to GSA	1	1	1
23.2	Rents, other	0	0	0
23.3	Communication, utilities & misc. charges	19	34	36
25.1	Consulting Services	320	487	482
25.2	Other Services	1307	1,411	1,534
25.3	Purchases from Government Accounts	0	0	0
25.4	O&M of Facilities	0	0	0
25.5	R & D Contracts	8	8	8
26.0	Supplies and materials	135	483	529
31.0	Equipment	0	0	0
32.0	Lands and structures	52	52	60
41.0	Grants, subsidies, contributions	266	89	91
43.0	Interest and dividends	575	773	830
99.0	**Total obligations**	**3,003**	**3,799**	**4,054**

Estimate of Proprietary Receipts
(in millions of dollars)

	Fiscal Year						
	2009	2010	2011	2012	2013	2014	2015
Reclamation Interest	43	43	43	43	43	40	40
Reclamation Amortization	0	1	0	0	44	0	0
Reclamation O&M	1	0	0	0	0	0	0
Reclamation Irrig. Assist.	7	0	0	1	60	54	122
Revenues Collected by Reclamation Distributed in Treasury Account (credit)	-13	-7	-7	-7	-7	-7	-7
Colville Settlement (credit)	-5	-5	-5	-5	-5	-5	-5
Total 1/ Reclamation Fund	**33**	**32**	**31**	**32**	**135**	**82**	**150**
Corps O&M	6						
CSRS	33	31	31	32	33	34	34
Total 2/ Repayments on misc.costs	**39**	**31**	**31**	**32**	**33**	**34**	**34**

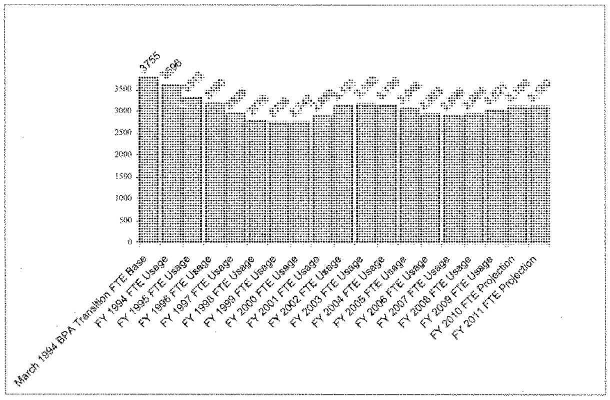
1/ Includes amortization of appropriations and irrigation assistance, and interest costs for Reclamation. The cost of power O&M for Reclamation is no longer included in Proprietary Receipts due to Direct Funding by Bonneville. Represents transfer to Account #895000.26

2/ The costs of power O&M for the Corps and Lower Snake Comp. Plan are no longer included in Proprietary Receipts due to Direct Funding by Bonneville. Represents transfers to Account #892889, Repayments on misc. recoverable costs, not otherwise classified. Costs for power O&M is funded directly by Bonneville as follows (in millions)

	2009	2010	2011	2012	2013	2014	2015
Bureau of Reclamation	78	87	96	105	107	110	114
Corps of Engineers	178	191	192	201	207	213	220
Lower Snake River Comp. Plan	21	24	24	26	27	27	28

See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

BONNEVILLE FTE
(revised December 2009)



BPA has utilized the following number of VSIPs: 190 in FY 1994, 240 in FY 1995, 137 in FY 1996, 135 in FY 1997, 121 in FY 1998, 81 in FY 1999, 43 in FY 2000, 12 in FY 2001, 0 in FY 2002, 80 in FY 2003, 0 in FY 2004, 98 in 2005, 35 in FY 2006, 37 in FY 2007, and 31 in FY 2008.

BPA continues to assume various authorities, including the use of VSIPs and VERA to help achieve BPA planning levels.

Actual FTE data is consistent with DOE personnel reports.

FTE outyear data are estimates and may change.

BONNEVILLE POWER ADMINISTRATION

FISH AND WILDLIFE COSTS [1]

COST ELEMENT	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
CAPITAL INVESTMENTS [2]										
BPA FISH AND WILDLIFE	13.9	16.5	6.1	11.6	8.5	12.2	36.3	36.2	26.9	27.8
ASSOCIATED PROJECTS (FEDERAL HYDRO)	47.0	6.2	8.8	68.4	75.9	53.8	360.0	60.4	37.3	135.7
TOTAL CAPITAL INVESTMENTS	60.9	22.7	14.9	80.0	84.4	66.0	396.3	96.6	64.2	163.5
PROGRAM EXPENSES										
BPA DIRECT FISH AND WILDLIFE PROGRAM	108.2	101.1	137.1	140.7	137.9	135.8	137.9	139.5	148.9	178.1
SUPPLEMENTAL MITIGATION PROGRAM EXPENSES [3]		2.9	7.1	6.5	7.8	0.0	0.0	0.0	0.0	0.0
REIMBURSABLE/DIRECT-FUNDED PROJECTS [4]										
O & M LOWER SNAKE RIVER HATCHERIES	12.4	12.7	14.9	15.1	17.3	17.2	20.1	19.3	19.4	20.8
O & M CORPS OF ENGINEERS	19.7	23.1	28.2	30.3	32.3	32.5	31.8	32.9	34.4	34.3
O & M BUREAU OF RECLAMATION	1.8	3.0	3.8	3.1	3.9	3.9	4.5	3.9	4.3	4.5
OTHER (NW POWER AND CONSERVATION COUNCIL)	3.7	3.7	4.0	4.0	3.7	4.3	4.3	4.2	4.1	4.7
SUBTOTAL (REIMB/DIRECT-FUNDED)	37.6	42.5	50.9	52.6	57.2	57.9	60.7	60.3	62.2	64.3
TOTAL OPERATING EXPENSES	**145.8**	**146.5**	**195.1**	**199.8**	**202.9**	**193.7**	**198.6**	**199.7**	**211.1**	**242.4**
PROGRAM RELATED FIXED EXPENSES [5]										
INTEREST EXPENSE	48.4	49.1	48.5	49.9	53.3	56.4	53.4	76.0	76.9	78.7
AMORTIZATION EXPENSE	16.1	16.8	17.2	17.4	17.5	17.4	17.4	22.9	24.4	24.6
DEPRECIATION EXPENSE	11.8	12.3	12.5	13.2	14.6	15.9	16.7	14.0	14.9	16.7
TOTAL FIXED EXPENSES	**76.3**	**78.2**	**78.2**	**80.5**	**85.4**	**89.7**	**87.5**	**112.9**	**116.2**	**120.0**
GRAND TOTAL PROGRAM EXPENSES	**222.1**	**224.7**	**273.3**	**280.3**	**288.3**	**283.4**	**286.1**	**312.6**	**327.3**	**362.4**
FOREGONE REVENUES AND POWER PURCHASES										
FOREGONE REVENUES	193.1	115.9	12.6	79.2	21.7	182.1	397.4	282.6	273.5	142.8
BPA POWER PURCH. FOR FISH ENHANCEMENT	64.8	1,389.6	147.8	171.1	191.0	110.8	168.2	120.7	274.9	240.3
TOTAL FOREGONE REVENUES AND POWER PURCHASES	**257.9**	**1,505.5**	**160.4**	**250.3**	**212.7**	**292.9**	**565.6**	**403.3**	**548.5**	**383.1**
TOTAL PROGRAM EXPENSES, FOREGONE REVENUES, & POWER PURCHASES	**480.0**	**1,730.2**	**433.7**	**530.6**	**501.0**	**576.3**	**851.7**	**715.9**	**875.8**	**745.5**
CREDITS										
4(h)(10)(C) credits earned	(50.4)	(336.6)	(66.4)	(73.6)	(77.0)	(57.7)	(76.4)	(66.1)	(100.5)	(99.5)
FISH COST CONTINGENCY FUND [6]	-	(246.5)	-	(78.7)	-	-	-	-	-	-
TOTAL CREDITS	**(50.4)**	**(583.1)**	**(66.4)**	**(152.3)**	**(77.0)**	**(57.7)**	**(76.4)**	**(66.1)**	**(100.5)**	**(99.5)**

1/ For purposes of this presentation, this financial information has been made publicly available by BPA in April 2009 and is consistent with the financial system of record used in preparation of the audited financial statements for the respective period reported

2/ Capital Investments include both BPA's direct Fish and Wildlife Program capital investments, funded by BPA's Treasury borrowing, and "Associated Projects", which include capital investments at the Corps and Reclamation projects, funded by appropriations and repaid by BPA.

3/ Includes High Priority and Action Plan Expenses and other supplemental programs.

4/ Reimbursable/Direct-Funded Projects includes the portion of costs BPA pays to or on behalf of other entities that is determined to be for fish and wildlife purposes

5/ Fixed Expenses include depreciation and interest on investment on the Corps projects, and amortization and interest on the investments associated with BPA's direct Fish and Wildlife Program.

6/ The Fish Contingency Fund was exhausted in 2003

GENERAL PROVISIONS

[SEC. 301. None of the funds appropriated by this Act may be used to prepare or initiate Requests For Proposals (RFPs) for a program if the program has not been funded by Congress.]

[SEC. 302. None of the funds appropriated by this Act may be used—

(1) to augment the funds made available for obligation by this Act for severance payments and other benefits and community assistance grants under section 4604 of the Atomic Energy Defense Act (50 U.S.C. 2704) unless the Department of Energy submits a reprogramming request to the appropriate congressional committees; or

(2) to provide enhanced severance payments or other benefits for employees of the Department of Energy under such section; or

(3) develop or implement a workforce restructuring plan that covers employees of the Department of Energy.]

SEC. [303]*301.* The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. [304]*302.* None of the funds in this or any other Act for the Administrator of the Bonneville Power Administration may be used to enter into any agreement to perform energy efficiency services outside the legally defined Bonneville service territory, with the exception of services provided internationally, including services provided on a reimbursable basis, unless the Administrator certifies in advance that such services are not available from private sector businesses.

SEC. [305]*303.* When the Department of Energy makes a user facility available to universities or other potential users, or seeks input from universities or other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users. When the Department of Energy considers the participation of a university or other potential user as a formal partner in the establishment or operation of a user facility, the Department shall employ full and open competition in selecting such a partner. For purposes of this section, the term "user facility" includes, but is not limited to:

(1) a user facility as described in section 2203(a)(2) of the Energy Policy Act of 1992 (42 U.S.C. 13503(a)(2));

(2) a National Nuclear Security Administration Defense Programs Technology Deployment Center/User Facility; and

(3) any other Departmental facility designated by the Department as a user facility.

SEC. [306]*304.* Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 414) during fiscal year [2010] *2011* until the enactment of the Intelligence Authorization Act for fiscal year [2010] *2011.*

SEC. [307]*305.* Of the funds made available by the Department of Energy for activities at Government-owned, contractor-operated laboratories funded in this Act or subsequent Energy and Water Development Appropriations Acts, the Secretary may authorize a specific amount, not to exceed 8 percent of such funds, to be used by such laboratories for laboratory directed research and development: *Provided*, That the Secretary may also authorize a specific amount not to exceed 4 percent of such funds, to be used by the plant manager of a covered nuclear weapons production plant or the manager of the Nevada Site Office for plant or site directed research and development.

SEC. [308]*306*. (a) In any fiscal year in which the Secretary of Energy determines that additional funds are needed to reimburse the costs of defined benefit pension plans for contractor employees, the Secretary may transfer not more than 1 percent from each appropriation made available in this and subsequent Energy and Water Development Appropriation Acts to any other appropriation available to the Secretary in the same Act for such reimbursements.

[(b) Where the Secretary recovers the costs of defined benefit pension plans for contractor employees through charges for the indirect costs of research and activities at facilities of the Department of Energy, if the indirect costs attributable to defined benefit pension plan costs in a fiscal year are more than charges in fiscal year 2008, the Secretary shall carry out a transfer of funds under this section.]

([c]*b*) In carrying out a transfer under this section, the Secretary shall use each appropriation made available to the Department in that fiscal year as a source or the transfer, and shall reduce each appropriation by an equal percentage, except that appropriations for which the Secretary determines there exists a need for additional funds for pension plan costs in that fiscal year, as well as appropriations made available for the Power Marketing Administrations, the title XVII loan guarantee program, and the Federal Energy Regulatory Commission, shall not be subject to this requirement.

([d]*c*) Each January, the Secretary shall report to the Committees on Appropriations of the House of Representatives and the Senate on the state of defined benefit pension plan liabilities in the Department for the preceding year.

([e]*d*) This transfer authority does not apply to supplemental appropriations, and is in addition to any other transfer authority provided in this or any other Act. The authority provided under this section shall expire on September 30, 2015.

([f]*e*) The Secretary shall notify the Committees on Appropriations of the House of Representatives and the Senate in writing not less than 30 days in advance of each transfer authorized by this section.

[SEC. 309. (a) Subject to subsection (b), no funds appropriated or otherwise made available by this Act or any other Act may be used to record transactions relating to the increase in borrowing authority or bonds outstanding at any time under the Federal Columbia River Transmission System Act (16 U.S.C. 838 et seq.) referred to in section 401 of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 140) under a funding account, subaccount, or fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol.

(b) Funds appropriated or otherwise made available by this Act or any other Act may be used to ensure, for purposes of meeting any applicable reporting provisions of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 115), that the Bonneville Power Administration uses a fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol solely to report accrued expenditures of projects attributed by the Administrator of the Bonneville Power Administration to the increased borrowing authority.

(c) This section is effective for fiscal year 2010 and subsequent fiscal years.]

[SEC. 310. Section 1702 of the Energy Policy Act of 2005 (42 U.S.C. 16512) is amended by adding at the end the following new subsection:

"(k) WAGE RATE REQUIREMENTS.—All laborers and mechanics employed by contractors and subcontractors in the performance of construction work financed in whole or in part by a loan guaranteed under this title shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards in this subsection, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code.".]

[SEC. 311. None of the funds made available by this Act may be used to make a grant allocation, discretionary grant award, discretionary contract award, Other Transaction Agreement, or to issue a letter of intent totaling in excess of $1,000,000, or to announce publicly the intention to make such an award, including a contract covered by the Federal Acquisition Regulation, unless the Secretary of Energy notifies the Committees on Appropriations of the Senate and the House of Representatives at least 3 full business days in advance of making such an award or issuing such a letter: *Provided*, That if the Secretary of the Department of Energy determines that compliance with this section would pose a substantial risk to human life, health, or safety, an award may be made without notification and the Committees on Appropriations of the Senate and the House of Representatives shall be notified not later than 5 full business days after such an award is made or letter issued.]

[SEC. 312. (a) ULTRA EFFICIENT VEHICLES.—Section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) is amended—
(1) in subsection (a)—
(A) in paragraph (1), by inserting "an ultra efficient vehicle or" after "means"; and
(B) by adding at the end the following new paragraph:
"(5) ULTRA EFFICIENT VEHICLE.—The term 'ultra efficient vehicle' means a fully closed compartment vehicle designed to carry at least 2 adult passengers that achieves—
"(A) at least 75 miles per gallon while operating on gasoline or diesel fuel;
"(B) at least 75 miles per gallon equivalent while operating as a hybrid electric-gasoline or electric-diesel vehicle; or
"(C) at least 75 miles per gallon equivalent while operating as a fully electric vehicle.";
(2) in subsection (b)—
(A) by inserting ", ultra efficient vehicle manufacturers," after "automobile manufacturers";
(B) in paragraph (1)—
(i) by striking "or" at the end of subparagraph (A);
(ii) by striking "and" at the end of subparagraph (B) and inserting "or"; and
(iii) by adding at the end the following new subparagraph:
"(C) ultra efficient vehicles; and"; and
(C) in paragraph (2), by inserting ", ultra efficient vehicles," after "qualifying vehicles";
(3) in subsection (g), by inserting "or are utilized primarily for the manufacture of ultra efficient vehicles" after "20 years"; and
(4) in subsection (h)(1)(B), by striking "automobiles" the first place it appears and inserting "ultra efficient vehicles, automobiles,".
(b) RECONSIDERATION OF PRIOR APPLICATIONS.—The Secretary of Energy shall reconsider applications for assistance under section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) that were—
(1) timely filed under that section before January 1, 2009;
(2) rejected on the basis that the vehicles to which the proposal related were not advanced technology vehicles; and
(3) related to ultra efficient vehicles.]

[SEC. 313. (a) Except as provided in subsection (b), none of the funds appropriated or otherwise made available by this title for the Strategic Petroleum Reserve may be made available to any person that as of the enactment of this Act—

(1) is selling refined petroleum products valued at $1,000,000 or more to the Islamic Republic of Iran;

(2) is engaged in an activity valued at $1,000,000 or more that could contribute to enhancing the ability of the Islamic Republic of Iran to import refined petroleum products, including—

(A) providing ships or shipping services to deliver refined petroleum products to the Islamic Republic of Iran;

(B) underwriting or otherwise providing insurance or reinsurance for such an activity; or

(C) financing or brokering such an activity; or

(3) is selling, leasing, or otherwise providing to the Islamic Republic of Iran any goods, services, or technology valued at $1,000,000 or more that could contribute to the maintenance or expansion of the capacity of the Islamic Republic of Iran to produce refined petroleum products.

(b) The prohibition on the use of funds under subsection (a) shall not apply with respect to any contract entered into by the United States Government before the date of the enactment of this Act.

(c) If the Secretary determines a person made ineligible by this section has ceased the activities enumerated in (a)(1)-(3), that person shall no longer be ineligible under this section.]

[SEC. 314. Section 132 of the Energy and Water Development Appropriations Act of 2006 (119 Stat 2261) is amended—

(1) in subsection (a)(3), by striking "Corps of Engineers" and inserting "Southwestern Power Administration";

(2) by adding at the end of subsection (a) the following new paragraph:

"(5) PAYMENT TO NON-FEDERAL LICENSEE.—Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 pursuant to paragraph (3) using receipts collected from the sale of Federal power and energy related services. Pursuant to paragraph (6), Southwestern Power Administration will begin collecting receipts in the Special Receipts and Disbursement account upon the date of enactment of this paragraph. Payment to the licensee of Federal Energy Regulatory Commission Project No. 2221 shall be paid as soon as adequate receipts are collected in the Special Receipts and Disbursement Account to fully compensate the licensee, and in accordance with paragraph (2), such payment shall be considered non-reimbursable.";

(3) by adding at the end of subsection (a) the following new paragraph:

"(6) The Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 in annual payments of not less than $5,000,000, until the licensee of Federal Energy Regulatory Commission Project No. 2221 is fully compensated pursuant to paragraph (3). At the end of each fiscal year subsequent to implementation, any remaining balance to be paid to the licensee of Project No. 2221 shall accrue interest at the 30-year U.S. Treasury bond rate in effect at the time of implementation of the White River Minimum Flows project.";

(4) by adding at the end of subsection (a) the following new paragraph:

"(7) ESTABLISHMENT OF SPECIAL RECEIPT AND DISBURSEMENT ACCOUNTS.—There is established in the Treasury of the United States a special receipt account and corresponding disbursement account to be made available to the Administrator of the Southwestern Power Administration to disburse pre-collected receipts from the sale of federal power and energy and related services. The accounts are authorized for the following uses:

"(A) Collect and disburse receipts for purchase power and wheeling expenses incurred by Southwestern Power Administration to purchase replacement power and energy as a result of implementation of the White River Minimum Flows project.

"(B) Collect and disburse receipts related to compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221.

"(C) Said special receipt and disbursement account shall remain available for not more than 12 months after the date of full compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221."; and

(5) by adding at the end of subsection (a) the following new paragraph:

"(8) TIME OF IMPLEMENTATION.—For purposes of paragraphs (3) and (4), `time of implementation' shall mean the authorization of the special receipt account and corresponding disbursement account described in paragraph (7).".]

SEC. 307. (a) Section 1801 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g) is amended in subsection (b)(2) by striking "amounts contained within the Fund" and inserting "assessments collected pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) as amended".

(b) Section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) is amended:

(1) in subsection (a):

(A) by striking *"$518,233,333" and inserting "$663,000,000"; and*

(B) by striking *"on October 24, 1992" and inserting "with fiscal year 2012".*

(2) in subsection (c):

(A) by inserting *"(1)" before "The Secretary";*

(B) by inserting *after "utilities": ", only to the extent provided in advance in appropriation Acts";*

(C) by striking "$150,000,000" and inserting "$200,000,000";

(D) by inserting *"beginning in fiscal year 2012" after "adjusted for inflation";*

(E) by striking "(1)" and inserting "(A)";

(F) by striking "(2)" and inserting "(B)";

(G) by adding a new paragraph 2, ",(2) Amounts authorized to be collected pursuant to this section shall be deposited in the Fund and credited as offsetting receipts."

(3) in subsection (d), by striking "for the period encompassing 15 years after the date of the enactment of this title" and inserting "through fiscal year 2026"; and

(4) in subsection (e):

(A) in paragraph (1), by striking "15 years after the date of the enactment of this title" and inserting "September 30, 2026";

(B) in *paragraph (2), by striking "$2,250,000,000" and inserting "$3,000,000,000"; and*

(C) in *paragraph (2) by inserting "beginning in fiscal year 2012" after "adjusted for inflation".*

SEC. 308. The Secretary shall collect up to $200,000,000 in assessments pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1), as amended by this Act.

SEC. 309. For an additional amount for the "Other Defense Activities" account, $11,891,755, to increase the Department's acquisition workforce capacity and capabilities: Provided, That such funds may be transferred by the Secretary to any other account in the Department to carry out the purposes provided herein: Provided further, That such transfer authority is in addition to any other transfer authority provided in this Act: Provided further, That such funds shall be available only to supplement and not to supplant existing acquisition workforce activities: Provided further, That such funds shall be available for training, recruitment, retention, and hiring additional members of the acquisition workforce as defined by the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 401 et seq.): Provided further, That such funds shall be available for information technology in support of acquisition workforce effectiveness or for management solutions to improve acquisition management.

SEC. 310. Not to exceed 5 per centum, or $100,000,000, of any appropriation, whichever is less, made available for Department of Energy activities funded in this Act or subsequent Energy and Water Development and Related Agencies Appropriation Acts may hereafter be transferred between such *appropriations, but no appropriation, except as otherwise provided, shall be increased or decreased by more that 5 per centum by any such transfers, and any such proposed transfers shall be submitted to the Committee on Appropriations of the House and Senate. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. To the extent practicable funds made available in this Act should be used to purchase light bulbs that are "Energy Star" qualified or have the "Federal Energy Management Program" designation.

[SEC. 503. Title IV of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5) is amended by adding at the end of the title, the following new section 411:

"SEC 411. Up to 0.5 percent of each amount appropriated to the Department of the Army and the Bureau of Reclamation in this title may be used for the expenses of management and oversight of the programs, grants, and activities funded by such appropriation, and may be transferred by the Head of the Federal Agency involved to any other appropriate account within the department for that purpose: *Provided*, That the Secretary will provide a report to the Committees on Appropriations of the House of Representatives and the Senate 30 days prior to the transfer: *Provided further*, That funds set aside under this section shall remain available for obligation until September 30, 2012.".]

[SEC. 504. (a) DEFINITIONS.—In this section:

(1) *ADMINISTRATIVE* EXPENSES.—The term "administrative expenses" has the meaning as determined by the Director under subsection (b)(2).

(2) *AGENCY*.—The term "agency"—

(A) means an agency as defined under section 1101 of title 31, United States Code, that is established in the executive branch and receives funding under this Act; and

(B) shall not include the District of Columbia government.

(3) *DIRECTOR*.—The term "Director" means the Director of the Office of Management and Budget.

(b) ADMINISTRATIVE EXPENSES.—

(1) IN *GENERAL*.—All agencies shall include a separate category for administrative expenses when submitting their appropriation requests to the Office of Management and Budget for fiscal year 2011 and each fiscal year thereafter.

(2) *ADMINISTRATIVE* EXPENSES DETERMINED.—In consultation with the agencies, the Director shall establish and revise as necessary a definition of administration expenses for the purposes of this section. All questions regarding the definition of administrative expenses shall be resolved by the Director.

(c) BUDGET SUBMISSION.—Each budget of the United States Government submitted under section 1105 of title 31, United States Code, for fiscal year 2011 and each fiscal year thereafter shall include the amount requested for each agency for administrative expenses.]

[SEC. 505. None of the funds made available in this Act may be transferred to any department, agency, or instrumentality of the United States Government, except pursuant to a transfer made by, or transfer authority provided in this Act or any other appropriation Act.]

SEC. [506]*503*. [Specific projects contained in] *To the extent that* the report of the Committee on Appropriations of the House of Representatives accompanying this Act [(H. Rept. 111-203)] *includes specific projects* that are considered congressional earmarks for purposes of clause 9 of rule XXI of the Rules of the House of Representatives, *such projects,* when intended to be awarded to a for-profit entity, shall be awarded under a full and open competition. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

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Volume 7

Department of Energy
FY 2011 Congressional Budget Request

Nuclear Energy
Defense Nuclear Waste Disposal
Nuclear Waste Disposal

February 2010 Office of Chief Financial Officer Volume 7

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Volume 7

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The Department of Energy's Congressional Budget justification is available on the Office of Chief Financial Officer, Office of Budget homepage at http://www.cfo.doe.gov/crorg/cf30.htm.

For the latest details on the Department of Energy's implementation of the Recovery Act, please visit: http://www.energy.gov/recovery

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2009 Current Approp.	FY 2009 Current Recovery	FY 2010 Current Approp.	FY 2011 Congressional Request	FY 2011 vs. FY 2010	
					$	%
Discretionary Summary By Appropriation						
Energy And Water Development, And Related Agencies						
Appropriation Summary:						
Energy Programs						
Energy Efficiency and Renewable Energy	2,156,865	16,771,907	2,242,500	2,355,473	+112,973	+5.0%
Electricity Delivery and Energy Reliability	134,629	4,495,712	171,982	185,930	+13,948	+8.1%
Nuclear energy	791,444	0	786,637	824,052	+37,415	+4.8%
Fossil Energy Programs						
Clean Coal Technology	0	0	0	0	—	—
Fossil Energy Research and Development	863,104	3,398,607	672,383	586,583	-85,800	-12.8%
Naval Petroleum and Oil Shale Reserves	19,099	0	23,627	23,614	-13	-0.1%
Strategic Petroleum Reserve	226,586	0	243,823	138,861	-104,962	-43.0%
Strategic Petroleum Account	-21,586	0	0	0	—	—
Northeast Home Heating Oil Reserve	9,800	0	11,300	11,300	—	—
Total, Fossil Energy Programs	1,097,003	3,398,607	951,133	760,358	-190,775	-20.1%
Uranium Enrichment D&D Fund[1]	535,503	390,000	573,850	730,498	+156,648	+27.3%
Energy Information Administration	110,595	0	110,595	128,833	+18,238	+16.5%
Non-Defense Environmental Cleanup	261,819	483,000	254,673	225,163	-29,510	-11.6%
Science	4,813,470	1,632,918	4,903,710	5,121,437	+217,727	+4.4%
Energy Transformation Acceleration Fund	8,700	388,856	0	299,966	+299,966	N/A
Nuclear Waste Disposal	145,390	0	98,400	0	-98,400	-100.0%
Departmental Administration	155,326	42,000	168,944	169,132	+188	+0.1%
Inspector General	51,927	15,000	51,927	42,850	-9,077	-17.5%
Advanced Technology Vehicles Manufacturing Loan Program	7,510,000	10,000	20,000	9,998	-10,002	-50.0%
Innovative Technology Loan Guarantee Program	0	0	0	500,000	+500,000	N/A
Section 1705 Temporary Loan Guarantee Program	0	3,960,000	0	0	—	—
Total, Energy Programs	17,772,671	31,588,000	10,334,351	11,353,690	+1,019,339	+9.9%
Atomic Energy Defense Activities						
National Nuclear Security Administration:						
Weapons Activities	6,410,000	0	6,384,431	7,008,835	+624,404	+9.8%
Defense Nuclear Nonproliferation	1,545,071	0	2,136,709	2,687,167	+550,458	+25.8%
Naval Reactors	828,054	0	945,133	1,070,486	+125,353	+13.3%
Office of the Administrator	439,190	0	410,754	448,267	+37,513	+9.1%
Total, National Nuclear Security Administration	9,222,315	0	9,877,027	11,214,755	+1,337,728	+13.5%
Environmental and Other Defense Activities:						
Defense Environmental Cleanup[1]	5,656,345	5,127,000	5,642,331	5,588,039	-54,292	-1.0%
Other Defense Activities						
Health, Safety and Security	446,471	0	441,882	464,211	+22,329	+5.1%
Legacy Management	185,981	0	189,802	188,626	-1,176	-0.6%
Nuclear Energy	565,819	0	83,358	88,200	+4,842	+5.8%
Defense Related Administrative Support	108,190	0	122,982	130,728	+7,746	+6.3%
Office of Hearings and Appeals	6,603	0	6,444	6,444	—	—
Congressionally Directed Projects	999	0	3,000	0	-3,000	-100.0%
Total, Other Defense Activities	1,314,063	0	847,468	878,209	+30,741	+3.6%
Defense Nuclear Waste Disposal	143,000	0	98,400	0	-98,400	-100.0%
Total, Environmental & Other Defense Activities	7,113,408	5,127,000	6,588,199	6,466,248	-121,951	-1.9%
Total, Atomic Energy Defense Activities	16,335,723	5,127,000	16,465,226	17,681,003	+1,215,777	+7.4%
Power Marketing Administrations:						
Southeastern Power Administration	7,420	0	0	0	—	—
Southwestern Power Administration	28,414	0	13,076	12,699	-377	-2.9%
Western area Power Administration	218,346	10,000	109,181	105,558	-3,623	-3.3%
Falcon & Amistad Operating & Maintenance Fund	2,959	0	220	220	—	—
Colorado River Basins	-23,000	0	-23,000	-23,000	—	—
Total, Power Marketing Administrations	234,139	10,000	99,477	95,477	-4,000	-4.0%
Federal Energy Regulatory Commission	0	0	0	0	—	—
Subtotal, Energy And Water Development and Related Agencies	34,342,533	36,725,000	26,899,054	29,130,170	+2,231,116	+8.3%
Uranium Enrichment D&D Fund Discretionary Payments	-463,000	0	-463,000	-696,700	-233,700	-50.5%
Excess Fees and Recoveries, FERC	-23,080	0	-28,886	-29,111	-225	-0.8%
Cost of Implementing Reclassification of Receipts, PMAs	0	0	189,384	0	-189,384	-100.0%
Total, Discretionary Funding	**33,856,453**	**36,725,000**	**26,596,552**	**28,404,359**	**+1,807,807**	**+6.8%**

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[1] The Defense Environmental Cleanup/Uranium Enrichment Decontamination and Decommissioning Fund accounts reflect correctly the Administration's policy for the Department's FY 2011 request. These accounts include $47 million that was inadvertently omitted from the official Budget request. A budget amendment is expected to be forthcoming to formally correct for this error.

Nuclear Energy

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Nuclear Energy

(including transfer of funds)

Proposed Appropriation Language

For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for nuclear energy activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and the purchase of not more than [36 passenger motor vehicles, including one ambulance]9 buses, all for replacement only, [$786,637,000] $824,052,000, to remain available until expended[: Provided, That, of the amount appropriated in this paragraph, $2,500,000 shall be used for projects specified in the table that appears under the heading ``Congressionally Directed Nuclear Energy Projects" in the joint explanatory statement accompanying the conference report on this Act]. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

Nuclear Energy
Office of Nuclear Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Nuclear Energy Appropriation				
Integrated University Program	5,000	0	5,000	0
RE-ENERGYSE	0	0	0	5,000
Nuclear Power 2010	177,500	0	105,000	0
Generation IV Nuclear Energy Systems	178,649	0	220,137	0
Reactor Concepts Research, Development and Demonstration	0	0	0	195,000
Nuclear Hydrogen Initiative	7,343	0	0	0
Fuel Cycle Research and Development	142,652	0	136,000	201,000
Nuclear Energy Enabling Technologies	0	0	0	99,300
Radiological Facilities Management	66,146	0	72,000	66,818
Idaho Facilities Management	140,000	0	173,000	162,482
Idaho Sitewide Safeguards and Security	78,811	0	0	0
Program Direction	73,000	0	73,000	91,452
International Nuclear Energy Cooperation	0	0	0	3,000
Congressionally Directed Projects	2,854	0	2,500	0
Subtotal, Nuclear Energy Appropriation	871,955	0	786,637	824,052
Transfer from State Department	3,300	0	0	0
Use of Prior Year Balance	-5,000	0	0	0
Funding from Other Defense Activities	-78,811	0	0	0
Total, Nuclear Energy Appropriation	791,444	0	786,637	824,052

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Other Defense Activities (NE) Appropriation[a]				
Idaho Sitewide Safeguards and Security	78,811	0	83,358	88,200
Total Other, Defense Activities Appropriation	565,819	0	83,358	88,200
Total Nuclear Energy and Other Defense Activities (NE) Appropriations	1,357,263	0	869,995	912,252

Preface

The Office of Nuclear Energy (NE) supports the diverse civilian nuclear energy programs of the U.S. Government, leading Federal efforts to research and develop nuclear energy technologies, including generation, safety, waste storage and management, and security technologies, to help meet energy and climate goals. NE's longer-term, science-based nuclear energy research and development (R&D) complements the near-term strategy to support the revitalization of the nuclear industry through loan guarantees provided by the Department of Energy's (DOE) Loan Guarantee Program.

Within the Nuclear Energy Appropriation NE funds: RE-ENERGYSE, Reactor Concepts Research, Development and Demonstration (RD&D), Nuclear Energy Enabling Technologies (NEET), Fuel Cycle (R&D), Radiological Facilities Management (RFM), Idaho Facilities Management (IFM), International Nuclear Energy Cooperation, and Program Direction. The Idaho Sitewide Safeguards and Security program is funded under the Other Defense Activities Appropriation.

Mission

NE advances nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance and security barriers through research, development, and demonstration as appropriate.

Benefits

NE is working to develop innovative and transformative technologies to improve the competitiveness, safety and proliferation resistance of nuclear energy to support its continued use in the United States and abroad. NE has established programmatic goals that reflect nuclear power's continuing role in satisfying the demand for clean energy. Those goals include exploring, through RD&D: technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; understanding of options for nuclear energy to contribute to reduced carbon emissions outside the electricity sector; development of sustainable

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[a] Includes only the NE portion of the Other Defense Activities appropriation.

nuclear fuel cycles; and minimization of risks of nuclear proliferation and terrorism.
The suite of activities represented in this request are designed to support the development of advanced reactor designs and technologies, including reactors that could be capable of meeting electricity generation, co-generation of process heat, and performance demands beyond current base load nuclear power plants and advanced fuel cycle technologies. Additional activities in these programs will address barriers to the long-term operation of nuclear plants as well as the technical, cost, safety, proliferation resistance, and security issues associated with novel designs and innovative reactor concepts. A prominent influence on R&D direction is improving our understanding of proliferation risks as well as developing the technical means to mitigate them. To more effectively address these challenges, NE R&D programs have been restructured, as described below.

Beginning in FY 2011, the new Reactor Concepts RD&D program will carry on activities previously included under the Generation IV Nuclear Energy Systems (Gen IV) program, including the Next Generation Nuclear Plant project, R&D on Generation IV and other advanced nuclear reactor concepts, and R&D to support extending the life of the current Light Water Reactor fleet. In addition, the Reactor Concepts RD&D program scope will initiate work on Small Modular Reactors.

NE will lead future waste management activities including activities associated with the planned Blue Ribbon Commission and oversee ongoing responsibilities under the Nuclear Waste Policy Act. Through its Fuel Cycle R&D program, NE will continue to perform results-oriented, science based R&D on fuel cycle approaches and technologies, including exploration of new and advanced fuel types – such as high burn-up and inert matrix fuels – that may lead to improved performance in today's reactor technologies. The program will examine a full range of technologies and develop waste management options critical to the long term management of used fuel.

Complementing the RD&D activities carried out by the Reactor Concepts RD&D and Fuel Cycle R&D programs, the new NEET program will develop crosscutting and transformative technologies that directly support and complement NE's development of new and advanced reactor concepts and fuel cycle technologies. Within this program, activities will be carried out through directed research projects as well as through investigator-initiated projects selected through open, competitive solicitations. The investigator-initiated, peer reviewed program will be open to projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration. Also, the Energy Innovation Hub for Modeling and Simulation (HUB), previously included within the Gen IV program, is funded within the NEET program in FY 2011. The Hub's novel approach and products are prime examples of the crosscutting, transformative activities that will enhance many research areas within NEET.

Just as the scope of the NEET program is informed by key challenge areas associated with developing commercially-viable reactor and fuel cycle technologies, the outcomes of the R&D activities supported through the NEET program will yield important breakthroughs that may be applied to the specific technologies under development in the Reactor Concepts RD&D and Fuel Cycle R&D programs. This new program structure will advance current reactor designs and fuel cycle technologies, develop new reactor designs and technology, and encourage the identification and development of "outside the box" options in all aspects of the civilian nuclear energy program. All programs will be tightly coordinated and complementary to avoid duplication and spur innovation.

To help ensure the safe and secure deployment of civilian nuclear power world-wide, the new International Nuclear Energy Cooperation program will work cooperatively to share research results, and to strengthen officially approved international agreements and other relevant U.S. international commitments in civilian nuclear energy matters. This program will coordinate with the National Nuclear Security Administration and the Office of Policy and International Affairs in executing its activities.

In support of RE-ENERGYSE, a Department-wide effort to encourage students to pursue careers in science, engineering, and entrepreneurship related to clean energy, NE is requesting funds to support competitively-selected, merit-based one-year undergraduate scholarships and three-year graduate degree fellowships to M.S. and Ph.D. students enrolled in nuclear, science, engineering, and related fields at U.S. universities. NE will also continue to allocate up to 20 percent of funds appropriated for R&D to research conducted at universities and other higher-education institutions.

NE's infrastructure programs, including the IFM and RFM programs, ensure that the Department's nuclear facilities used for advanced nuclear energy technology R&D and the co-funded production (with National Aeronautics and Space Administration (NASA)) of power systems for space and national security needs are operated and maintained to support national priorities. Key activities conducted under these programs include ensuring NE facilities meet essential safety and environmental requirements and are maintained at user-ready levels as well as ensuring the safe and secure management of all special nuclear materials contained in these facilities.

NE's Research Reactor Infrastructure program will continue to provide fresh reactor fuel to and remove used fuel from, 26 operating university reactors that support nuclear energy R&D. In addition, the Department will initiate work to re-establish a domestic capability to produce plutonium-238 for use in radioisotope power systems (RPSs) required by certain NASA space missions and national security applications.

Performance

The Secretary has identified the following goals for DOE:

Goal 1: Innovation: Lead the world in science, technology, and engineering
Goal 2: Energy: Build a competitive, low-carbon economy and secure America's energy future
Goal 3: Security: Reduce nuclear dangers and environmental risks

NE supports Goal 2: Energy: Build a competitive, low-carbon economy and secure America's energy.

Nuclear energy is an important element of the diverse energy portfolio required to accomplish our national objectives. Nuclear power is a proven clean, affordable, domestic technology that is within the current U.S. energy portfolio. NE is charged with conducting the research, development, and demonstrations as appropriate required to address scientific and technical challenges associated with the continued and expanded use of this valuable energy resource. NE's R&D programs, through science discovery and innovation, support nuclear technology development activities designed to enhance America's energy future. NE's infrastructure programs, including the IFM and RFM programs, ensure that the Department's nuclear facilities used for advanced nuclear energy technology R&D and RPS production are operated and maintained such that they are able to support national priorities.

Basic and Applied R&D Coordination

Coordination between the Department's basic research and applied technology programs is a high priority for the Secretary of Energy. The Department has a responsibility to coordinate its basic and applied research programs to effectively integrate R&D by the science and technology communities (e.g., national laboratories, universities, and private companies) that support the DOE mission. Efforts have focused on improving communication and collaboration between federal program managers and increasing opportunities for collaborative efforts targeted at the interface of scientific research and technology development to ultimately accelerate DOE mission and national goals. Coordination between the basic and applied programs is also enhanced through joint programs, jointly-funded scientific facilities, and the program management activities of the DOE Small Business Innovation Research and Small Business Technology Transfer programs. Additionally, co-funding research activities and facilities at the DOE laboratories and funding mechanisms that encourage broad partnerships (e.g., Funding Opportunity Announcements) are also means by which the Department facilitates greater communication and research integration within the basic and applied research communities.

Facilities Maintenance and Repair

The Department's Facilities Maintenance and Repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded by this budget are displayed below.

Indirect-Funded Maintenance and Repair

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Idaho National Laboratory	16,417	17,078	17,768
Total, Indirect-Funded Maintenance and Repair	16,417	17,078	17,768

Direct-Funded Maintenance and Repair

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Idaho National Laboratory	16,023	16,409	20,994
Total, Direct-Funded Maintenance and Repair	16,023	16,409	20,994

Nuclear Energy
Office of Nuclear Energy

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Argonne National Laboratory			
Fuel Cycle Research and Development	18,930	10,518	12,896
Generation IV Nuclear Energy Systems	1,563	14,692	0
International Nuclear Energy Cooperation	0	0	350
Nuclear Energy Enabling Technologies	0	0	4,240
Nuclear Hydrogen Initiative	213	0	0
Radiological Facilities Management	800	0	0
Reactor Concepts Research, Development and Demonstration	0	0	15,649
Total, Argonne National Laboratory	21,506	25,210	33,135
Brookhaven National Laboratory			
Fuel Cycle Research and Development	900	650	447
Generation IV Nuclear Energy Systems	75	125	0
Nuclear Energy Enabling Technologies	0	0	330
Reactor Concepts Research, Development and Demonstration	0	0	220
Total, Brookhaven National Laboratory	975	775	997
Chicago Operations Office			
Generation IV Nuclear Energy Systems	35	20	0
Nuclear Hydrogen Initiative	20	0	0
Total, Chicago Operations Office	55	20	0
Idaho National Laboratory			
Fuel Cycle Research and Development	39,130	40,859	61,108
Generation IV Nuclear Energy Systems	116,023	118,912	0
Idaho Facilities Management	135,185	159,272	155,082
Integrated University Program	4,450	0	0
International Nuclear Energy Cooperation	0	0	1,000
Nuclear Energy Enabling Technologies	0	0	18,310
Nuclear Hydrogen Initiative	3,108	0	0
Radiological Facilities Management	10,927	9,840	9,840

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Reactor Concepts Research, Development and Demonstration	0	0	105,118
Total, Idaho National Laboratory	308,823	328,883	350,458
Idaho Operations Office			
Congressionally Directed Projects	2,854	2,500	0
Fuel Cycle Research and Development	38,871	23,170	40,200
Generation IV Nuclear Energy Systems	48,013	54,425	0
Idaho Facilities Management	3,250	10,726	5,000
Integrated University Program	550	5,000	0
Nuclear Energy Enabling Technologies	0	0	29,539
Nuclear Hydrogen Initiative	1,864	0	0
Nuclear Power 2010	176,894	77,280	0
Program Direction	32,676	31,937	33,449
Radiological Facilities Management	6,496	10,500	4,818
RE-ENERGYSE	0	0	5,000
Reactor Concepts Research, Development and Demonstration	0	0	36,900
Total, Idaho Operations Office	311,468	215,538	154,906
Lawrence Berkeley National Laboratory			
Fuel Cycle Research and Development	825	1,195	2,196
Generation IV Nuclear Energy Systems	0	200	0
Total, Lawrence Berkeley National Laboratory	825	1,395	2,196
Lawrence Livermore National Laboratory			
Fuel Cycle Research and Development	2,940	3,395	3,699
Generation IV Nuclear Energy Systems	0	200	0
Nuclear Energy Enabling Technologies	0	0	450
Reactor Concepts Research, Development and Demonstration	0	0	220
Total, Lawrence Berkeley National Laboratory	2,940	3,595	4,369
Los Alamos National Laboratory			
Fuel Cycle Research and Development	13,431	16,595	24,795
Generation IV Nuclear Energy Systems	345	355	0
International Nuclear Energy Cooperation	0	0	450

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Nuclear Energy Enabling Technologies	0	0	4,680
Radiological Facilities Management	25,550	32,030	27,030
Reactor Concepts Research, Development and Demonstration	0	0	1,094
Total, Los Alamos National Laboratory	39,326	48,980	58,049
NNSA Service Center			
Generation IV Nuclear Energy Systems	1,944	0	0
Total, NNSA Service Center	1,944	0	0
Oak Ridge National Laboratory			
Fuel Cycle Research and Development	11,025	10,365	11,902
Generation IV Nuclear Energy Systems	6,774	8,283	0
International Nuclear Energy Cooperation	0	0	400
Nuclear Energy Enabling Technologies	0	0	11,490
Radiological Facilities Management	18,085	15,160	5,160
Reactor Concepts Research, Development and Demonstration	0	0	15,656
Total, Oak Ridge National Laboratory	35,884	33,808	44,608
Oak Ridge Operations Office			
Program Direction	1,290	1,353	1,620
Total, Oak Ridge Operations Office	1,290	1,353	1,620
Pacific Northwest National Laboratory			
Fuel Cycle Research and Development	4,350	6,118	8,979
Generation IV Nuclear Energy Systems Initiative	0	500	0
Nuclear Energy Enabling Technologies	0	0	810
Reactor Concepts Research, Development and Demonstration	0	0	656
Total, Pacific Northwest National Laboratory	4,350	6,618	10,445
Radiological and Environmental Sciences Laboratory			
Idaho Facilities Management	585	0	0
Program Direction	2,899	5,163	5,498
Total, Radiological and Environmental Sciences Laboratory	3,484	5,163	5,498

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Sandia National Laboratories			
Fuel Cycle Research and Development	4,510	8,515	21,403
Generation IV Nuclear Energy Systems	1,275	1,500	0
Nuclear Energy Enabling Technologies	0	0	530
Nuclear Hydrogen Initiative	890	0	0
Radiological Facilities Management	1,350	1,300	0
Reactor Concepts Research, Development and Demonstration	0	0	656
Total, Sandia National Laboratories	8,025	11,315	22,589
Savannah River National Laboratory			
Fuel Cycle Research and Development	2,100	4,290	7,900
Generation IV Nuclear Energy Systems	0	160	0
Nuclear Energy Enabling Technologies	0	0	330
Nuclear Hydrogen Initiative	1,188	0	0
Total, Savannah River National Laboratory	3,288	4,450	8,230
Washington Headquarters			
Fuel Cycle Research and Development	5,640	10,330	5,475
Generation IV Nuclear Energy Systems	2,602	20,765	0
Idaho Facilities Management	980	3,002	2,400
International Nuclear Energy Cooperation	0	0	800
Nuclear Energy Enabling Technologies	0	0	28,591
Nuclear Hydrogen Initiative	60	0	0
Nuclear Power 2010	606	27,720	0
Program Direction	36,135	34,547	50,885
Radiological Facilities Management	2,938	3,170	19,970
Reactor Concepts Research, Development and Demonstration	0	0	18,831
Total, Washington Headquarters	48,961	99,534	126,952
Total, Nuclear Energy	793,144	786,637	824,052

Site Description

Argonne National Laboratory

Introduction

Argonne National Laboratory (ANL) is one of the Department of Energy's (DOE) scientific research laboratories and is the Nation's first national laboratory, chartered in 1946. ANL is located approximately 25 miles southwest of the Chicago Loop, occupies 1,500 acres, and is surrounded by a forest preserve.

Fuel Cycle Research and Development

ANL supports electrochemical separations and waste form development activities. ANL has the lead for key systems analysis activities and contributes to used nuclear fuel disposition research and development (R&D) and modeling and simulation activities.

Generation IV Nuclear Energy Systems

ANL continues to play an important role in conducting key R&D in support of the Generation IV Nuclear Energy Systems (Gen IV) program. ANL participates in system design and evaluation activities for the Gen IV systems, makes important contributions to Gen IV fuels and materials efforts, and leads or participates in joint projects with France, Korea, Canada, Euratom, and Japan. ANL is responsible for staffing one of two U.S. experts for the Generation IV International Forum Experts Group. ANL also supports the Idaho National Laboratory (INL) on the Next Generation Nuclear Plant (NGNP) in the area of reactor cavity cooling system modeling.

International Nuclear Energy Cooperation

ANL will provide technical assistance in the development of the Department's international nuclear technology strategies. ANL will also assist in the development of workshops to engage industry and foreign governments as well as provide technical support for key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, fuel cycle technologies, and other nuclear technologies.

Nuclear Energy Enabling Technologies

ANL provides technical support to various cross-cutting reactor technologies including fast reactor safety, system and components testing, and innovative materials development. ANL evaluates innovative reactor concepts and assesses integrated system performance, including the development of integrated performance and safety codes to support modeling and simulation.

Nuclear Hydrogen Initiative

ANL supported the program until its completion at the end of FY 2009 by conducting laboratory analyses of thermochemical hydrogen production methods, specifically alternative cycles other than sulfur-based cycles.

Radiological Facilities Management

ANL funding supports activities associated with the certification of Type-B shipping containers. These shipping containers are a critical part of the Department of Energy's program infrastructure that enables DOE to provide radioisotope power systems for use in national security applications and space exploration missions.

Reactor Concepts Research, Development and Demonstration
ANL provides essential support to advanced reactor concepts, particularly in the area of fast reactors. ANL participates in system design and evaluation activities for the Gen IV systems, makes important contributions to Gen IV fuels and materials efforts, and leads or participates in international collaborative projects. ANL is responsible for staffing one of two U.S. experts for the Generation IV International Forum Experts Group. ANL also supports the INL on the NGNP in the area of reactor cavity cooling system modeling.

Brookhaven National Laboratory
Introduction
The Brookhaven National Laboratory (BNL) is a multi-program laboratory located in Upton, New York. DOE's BNL conducts research in the physical, biomedical, and environmental sciences as well as in energy technologies. Brookhaven builds and operates major facilities available to university, industrial, and government scientists. BNL also performs a prospective benefits analysis of DOE's nuclear energy R&D portfolio.

Fuel Cycle Research and Development
BNL will provide support to systems analysis, material protection, and advanced fuels R&D.

Generation IV Nuclear Energy Systems
BNL provides support to the Proliferation Resistance and Physical Protection Working Group under the Generation IV International Forum.

Nuclear Energy Enabling Technologies
BNL will provide support to the proliferation risk assessment activities and under the Nuclear Energy Enabling Technologies (NEET) program.

Reactor Concepts Research, Development and Demonstration
BNL will provide support to Advanced Reactors Concepts by participating in expert groups on proliferation resistance.

Chicago Operations Office
Introduction
The Chicago Operations Office provides procurement, contract, cooperative agreement, and grant support.

Generation IV Nuclear Energy Systems
The Chicago Operations Office supports distribution of certain Gen IV funding.

Nuclear Hydrogen Initiative
The Chicago Operations Office supported distribution of certain Nuclear Hydrogen Initiative funding in FY 2009.

Idaho National Laboratory
Introduction
The INL is an extensive research and engineering complex that has been the center of nuclear energy research since 1949. It occupies 890 square miles in southeastern Idaho along the western edge of the

Snake River Plain, 42 miles northwest of Idaho Falls, Idaho. The INL consists of three main engineering and research campuses: (1) the Reactor Technology Complex at the site, (2) the Materials and Fuels Complex (MFC) at the site, and (3) the Research and Education Campus in Idaho Falls. As INL Landlord, NE also operates the Central Facilities Area at the site that provides support to all the compounds and campuses at the site. The Office of Nuclear Energy (NE) has Lead Program Secretarial Office responsibility for the Idaho Operations Office (ID). INL is the center for NE's strategic nuclear energy R&D enterprise. INL has a central role in Gen IV nuclear energy systems development and fuel cycle R&D, and space nuclear power and propulsion applications. While focused on its role as the center for nuclear R&D, as a multi-program national laboratory, INL also continues to pursue national security, and homeland security activities.

Fuel Cycle Research and Development
INL leads the Fuel Cycle R&D Technical Integration Office. INL has assembled a unique set of expertise across all technical areas important to fuel cycle programs. This expertise enables INL to fully integrate the range of information necessary to set requirements for all elements of the program. INL will be a key contributor in the development of a detailed program plan for the Department's fuel cycle R&D effort. INL has developed the VISION code and coordinated development of related databases used to analyze various fuel cycle scenarios, supports R&D on transmutation fuel and electrochemical separations techniques, and can perform the irradiations of transmutation fuels. Related facilities are concentrated at the MFC and at the Advanced Test Reactor, and include a complete suite of gloveboxes, hot cells, and dedicated equipment.

Generation IV Nuclear Energy Systems
INL is the lead laboratory for the NGNP program and conducts the program's technical integration activities, as well as integration activities for all Gen IV R&D activities. INL, together with Oak Ridge National Laboratory (ORNL), is the principal laboratory responsible for the development of advanced gas reactor fuel and materials R&D. INL is responsible for staffing the Technical Secretariat for the Generation IV International Forum. INL serves as the technical integrator of research for Light Water Reactors.

Idaho Facilities Management
INL is a multi-program national laboratory that employs R&D assets to pursue a wide range of nuclear power R&D and other national energy security activities. The purpose of the Idaho Facilities Management (IFM) program is to operate and maintain the INL infrastructure required to support mission needs and priorities in a manner that is in compliance with environment, safety and health rules and regulations. NE is responsible for 890 square miles of land west of Idaho Falls (the site) and numerous laboratory and administrative facilities located in the town of Idaho Falls. NE operates and maintains buildings, nuclear and radiological facilities, and associated support structures; a full complement of site wide utilities, including power, communications and data transmission systems; 800 miles of paved and unpaved roads; 61 miles of high voltage electrical transmission lines; and 14 miles of railroad track.

Integrated University Program
In FY 2009, INL supported the Integrated University Program by administering Investigator-Initiated R&D awards through the Center of Advanced Energy Studies.

International Nuclear Energy Cooperation
INL will support the development of the Department's international nuclear technologies strategies and international engagement with foreign countries. INL will also assist in coordinating government-to-government international bilateral and multilateral activities. In support of INEC's International R&D and Technical Coordination activities, INL will provide technical support to key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, fuel cycle technologies, and other nuclear technologies.

Nuclear Energy Enabling Technologies
INL provides technical support for cross-cutting technologies including advanced fuels, fabrication and construction methods, and proliferation risk assessment. INL has the lead on the development of advanced instruments and sensors for the existing light water reactor fleet.

Nuclear Hydrogen Initiative
INL provided leadership in executing the NHI through the completion of the program at the end of FY 2009.

Radiological Facilities Management
INL is responsible for maintaining facilities and equipment for the assembly, testing, and delivery of radioisotope power systems. This capability focuses on the assembly of the encapsulated Plutonium 238 (Pu-238) into heat sources, insertion of heat sources into generators, testing of the assembled generators, and delivery of the generators to customers. Activities also include the transfer of neptunium-237 (Np-237) inventory from the Savannah River Site (SRS) to the INL for use in the future for Pu-238 production. In FY 2008, INL began providing fuel for university research reactors including fuel for conversions from highly enriched uranium to low enriched uranium, and shipped spent fuel from university reactors to DOE's SRS.

Reactor Concepts Research, Development and Demonstration
INL is the lead laboratory for the NGNP program and conducts the program's technical integration activities, as well as integration activities for the Light Water Reactor Sustainability program. INL, together with ORNL, is the principal laboratory responsible for the development of advanced gas reactor fuel and materials R&D. INL is responsible for staffing the Technical Secretariat for the Generation IV International Forum.

Idaho Operations Office
Introduction
The ID provides procurement, contract, cooperative agreement, and grant support. This office also provides support for contractor security investigations conducted by the Federal Bureau of Investigation and the OPM for DOE Federal employees and contractors. ID provides procurement and management support for NE university funding activities. A potion of the funds allocated to ID will be competitively awarded for support of both mission-specific and mission-related activities. Recipients may include industry, national laboratories, universities, research institutions.

Fuel Cycle Research and Development
ID provides procurement support for the Fuel Cycle R&D program.

Generation IV Nuclear Energy Systems
ID provides procurement support for the NGNP program. ID is responsible for executing partnership agreements with industry to complete the conceptual design of the NGNP in FY 2010.

Idaho Facilities Management
ID provides procurement and management support for various community regulatory support to meet obligations defined in the following cross-cutting agreements: S.M. Stoller, Payment in Lieu of Taxes, Shoshone-Bannock Tribes, and the National Oceanic and Atmospheric Administration.

Integrated University Program
In FY 2010, ID will award competitively solicited scholarships and fellowships to graduate, post graduate, minority, and minority-serving institutions.

Nuclear Energy Enabling Technologies
ID provides procurement support and assists in developing competitive solicitations and cost-sharing arrangements to support cross-cutting reactor technologies. ID will provide procurement support to Headquarters for a competitively-awarded Energy Innovation Hub for Modeling and Simulation that will support validated advanced modeling and simulation tools through the virtual modeling of an existing, operating reactor.

Nuclear Hydrogen Initiative
ID managed a contract with General Atomics to perform R&D on the sulfur-iodine thermochemical cycle in FY 2009.

Nuclear Power 2010
ID provides procurement, contract, cooperative agreement and grant support for the Nuclear Power 2010 program.

Radiological Facilities Management
ID provides procurement, contract, cooperative agreement and grant support for the Research Reactor Infrastructure program

RE-ENERGYSE
ID will support and administer scholarships and fellowships awarded through the Department's RE-ENERGYSE initiative.

Reactor Concepts Research, Development and Demonstration
ID provides procurement support for the NGNP program and administers industry cost sharing arrangements.

Lawrence Berkeley National Laboratory

Introduction
Lawrence Berkeley National Laboratory (LBNL) has been a leader in science and engineering research for more then 70 years. Located on a 200 acre site in the hills above the University of California's Berkeley campus, adjacent to the San Francisco Bay, Berkeley Lab holds the distinction of being the oldest of the U.S. DOE's National Laboratories.

Fuel Cycle Research and Development
LBNL provides key support for generic repository performance due to the unique qualification of the laboratory's staff.

Generation IV Nuclear Energy Systems
LBNL supports the development of Gen IV reactor concepts.

Lawrence Livermore National Laboratory
Introduction
Lawrence Livermore National Laboratory (LLNL) is a multi-disciplinary R&D laboratory focused on national defense, which has two noncontiguous geographic locations in northern California. LLNL is approximately one square mile and is located 40 miles east of San Francisco. LLNL conducts research in advanced defense technologies, energy, environment, biosciences, and basic science.

Fuel Cycle Research and Development
LLNL provides expertise on the impact of separation technologies on the geologic repository and advanced computer simulations and modeling efforts.

Generation IV Nuclear Energy Systems
LLNL supports the development of Gen IV reactor concepts.

Nuclear Energy Enabling Technologies
LLNL provides support to the proliferation risk assessment activities under NEET.

Reactor Concepts Research, Development and Demonstration
LLNL supports the development of advanced reactor concepts.

Los Alamos National Laboratory
Introduction
Los Alamos National Laboratory (LANL) is a multi-disciplinary research facility located on approximately 28,000 acres near the town of Los Alamos in northern New Mexico. LANL is engaged in a variety of programs for DOE and other government agencies. LANL's primary mission is to engage in research and technical activities supporting the Nation's defense. LANL also supports DOE missions related to arms control, non-proliferation, nuclear material disposition, energy research, science and technology, and environmental management. R&D in the basic sciences, mathematics, and computing have a broad range of applications, including: national security, non-nuclear defense, nuclear and non-nuclear energy, atmospheric and space research, geoscience, bioscience, biotechnology, and the environment.

Fuel Cycle Research and Development
LANL is leading safeguards activities, and provides major support as the lead organization for oxide fuel research. LANL has unique facilities to measure and evaluate the nuclear data that are critical for the analyses of nuclear systems. LANL also provides expertise in the areas of advanced fuels, materials and accelerator-driven systems.

Generation IV Nuclear Energy Systems
LANL provides technical support in the modeling of various aspects of advanced reactor concepts.

International Nuclear Energy Cooperation

LANL will provide technical expertise in support of INEC activities and assist in coordinating international bilateral and multilateral activities. Activities include technical assistance in the development of the Department's strategies and international engagement with foreign countries.

Nuclear Energy Enabling Technologies

LANL leads activities associated with developing new tools and techniques to assess proliferation risks. LANL also provides technical support to several cross-cutting technologies to be developed under NEET, including transformational fuels and materials development.

Radiological Facilities Management

At LANL, the facilities at Technical Areas (TA) -3, -35, -48 and -55 provide unique national actinide capabilities in the areas of analytical chemistry, materials characterization, chemical diagnostics, radiochemistry, and applied spectroscopy. A portion of the Plutonium Facility-4 at the TA-55 is dedicated to Pu-238 activities and is used to purify and encapsulate Pu-238 used in radioisotope power sources for the National Aeronautics and Space Administration (NASA) space exploration missions and national security applications. LANL capabilities were expanded to include establishing a Pu-238 scrap recovery capability to recycle Pu-238 scrap for use in future missions.

Reactor Concepts Research, Development and Demonstration

LANL provides technical support in the precision measurement of nuclear data to support advanced reactor concepts.

NNSA Service Center

Introduction

The National Nuclear Security Administration (NNSA) Service Center provides procurement, contract, cooperative agreement, and grant support for the Gen IV program.

Generation IV Nuclear Energy Systems

In FY 2009, through contracts administered by the NNSA Service Center with General Atomics and Russian contractor, OKB Mechanical Engineering, engineering services and technical support were funded to perform R&D for the Gas Turbine Modular Helium Reactor development program in Russia.

Oak Ridge National Laboratory

Introduction

The ORNL is a DOE scientific research laboratory located in Oak Ridge, Tennessee. ORNL also maintains the DOE computer code system, software, and documentation at the Radiation Safety Information Computational Center (RSICC) and serves as a repository for DOE computational research activities, including computer software that is developed by the Nuclear Engineering Education Research (NEER) projects. The RSICC computer software is made available to nuclear engineering departments, Nuclear Energy Research Initiative and NEER awardees.

Fuel Cycle Research and Development

ORNL provides key support for fuels, separations and waste form R&D. ORNL also conducts safeguards and nuclear data research. ORNL provides materials expertise.

Generation IV Nuclear Energy Systems

ORNL and INL are the principal laboratories responsible for the R&D of advanced gas reactor fuel suitable for NGNP. ORNL also leads the development of the Gen IV Materials handbook efforts, conducts much of the materials testing in support of the Gen IV, and chairs the Project Management Board for the Very High Temperature Reactor Materials Project Arrangement under the Generation IV International Forum.

International Nuclear Energy Cooperation

ORNL will provide technical support for key international R&D and nuclear energy activities in areas of mutual interest, leveraging U.S. funding, and exchanging technical information related to innovative reactor concepts, fuel cycle technologies, and other nuclear technologies. ORNL will also assist in the implementation of the INEC bilateral and international R&D and policy engagement in the area of reactor technical evaluations and support.

Nuclear Energy Enabling Technologies

ORNL leads the advanced materials development activities and provides crosscutting technical support in the areas of advanced fuels, proliferation risk assessment and advanced methods for fabrication and construction.

Radiological Facilities Management

The Radiochemical Engineering Development Center (REDC) at the ORNL is the Department's production, storage, and distribution center for the heavy-element research activities with advanced hot cell capabilities. REDC along with the Irradiated Fuels Examination Laboratory and Irradiated Fuels Examination and Testing Facility provide experimental capability in support of advanced fuel and structural material examination and testing and advanced aqueous flow sheet development and testing activities for advanced reactor research. ORNL provides the unique capabilities for fabricating carbon insulator and iridium heat source components for radioisotope power sources used for NASA space exploration missions. These sophisticated heat source components are necessary for the safe operation of these power systems during normal operation and during launch, re-entry or other deployment accidents. ORNL, in cooperation with INL, is playing a key role in establishing the domestic capability to produce Pu-238 for use in NASA and national security missions. Facilities at ORNL could potentially be used to support the production effort.

Reactor Concepts Research, Development and Demonstration

ORNL and INL are the principal laboratories responsible for the R&D of advanced gas reactor fuel suitable for the NGNP. ORNL leads efforts related to Small Modular Reactor development and supports Reactor Concepts Research, Development and Demonstration (RD&D) activities in the area of advanced materials.

Pacific Northwest Laboratory

Introduction

Pacific Northwest Laboratory (PNL) is a multi-program laboratory located on approximately 640 acres of the Department's Hanford site. PNL also monitors a marine science lab in Sequim, Washington.

Fuel Cycle Research and Development

PNL has a key role in waste form activities by leveraging its history and expertise. PNL provides technical support in the areas of advanced separations, fuels, materials, safeguards and nonproliferation analysis, and systems analysis.

Generation IV Nuclear Energy Systems
PNL supports the development of Gen IV reactor concepts.

Nuclear Energy Enabling Technologies
PNL provides support to the proliferation risk assessment activities under NEET.

Reactor Concepts Research, Development and Demonstration
PNL supports the development of advanced reactor concepts.

Radiological and Environmental Sciences Laboratory

Introduction
The Radiological and Environmental Sciences Laboratory is a DOE-owned and operated Federal reference laboratory with core mission capabilities in radiation measurement and calibrations, and analytical chemistry.

Idaho Facilities Management
The laboratory conducts measurement quality assurance programs to assure that key DOE missions are completed in a safe and environmentally responsible manner.

Sandia National Laboratories

Introduction
Sandia National Laboratories (SNL) is a research and development facility located on approximately 18,000 acres on the Kirtland Air Force Base reservation near Albuquerque, New Mexico and has smaller facilities in Livermore, California and Tonopah, Nevada. The mission of SNL is to meet national needs in the nuclear weapons and related defense systems, energy security, and environmental integrity.

Fuel Cycle Research and Development
SNL support to Fuel Cycle R&D increases in FY 2011 due to the expansion of the used nuclear fuel (UNF) disposition technical area. SNL was the lead laboratory that coordinated and organized scientific work for the repository program. It will now provide that technical expertise to support UNF disposition.

SNL also provides systems analysis support, particularly in the area of transportation analysis. SNL also has the lead for certain nuclear safeguards and security activities.

The laboratory has also developed widely used computer codes and models to analyze reactor safety. These codes have been validated and verified, and have been integrated into the nuclear industry's regulatory infrastructure. In this context, extensive databases have been developed to support probabilistic risk assessment modeling and analyses.

Generation IV Nuclear Energy Systems
SNL R&D is focused on development of advanced gas turbo-machinery with helium or supercritical carbon dioxide as the working fluids.

Nuclear Energy Enabling Technologies
SNL provides support to the proliferation risk assessment activities under NEET.

Nuclear Hydrogen Initiative
SNL served as the technical integrator for NHI until the program's completion at the end of FY 2009, responsible for coordinating the participation of all laboratories in the development and conduct of the NHI R&D program. In FY 2009, SNL also conducted R&D on the sulfur-iodine and Hybrid Sulfur thermochemical processes.

Radiological Facilities Management
SNL continues to maintain the nuclear system safety basis and develop risk assessment tools in support of DOE responsibilities for public safety under the Atomic Energy Act and in fulfillment of DOE's role in the Presidential Launch Approval Process under Presidential Directive National Security Council Memorandum 25 (PD/NSC-25).

Reactor Concepts Research, Development and Demonstration
SNL provides support to advanced reactor concepts in the areas of gas turbo-machinery, reactor safety and proliferation resistance.

Savannah River National Laboratory
Introduction
The Savannah River National Laboratory (SRNL) is an extensive material production and engineering complex that has been a nuclear site since 1951 when construction began supporting the U.S. strategic weapons program. The SRS is now a multi-program operational site covering 310 square mile site near Aiken, South Carolina. Because of its Cold War nuclear legacy, there is a significant level of environmental management cleanup work being performed at the site. In addition to supporting NE programs, the SRS workforce continues to support NNSA's weapons disposition program. SRNL is a multi-program laboratory located on approximately 34 acres within the SRS.

Fuel Cycle Research and Development
SRNL conducts research on advanced aqueous separations, systems analysis, advanced safeguards, and waste form development. SRS provides engineering analysis support as well.

Generation IV Nuclear Energy Systems
SRNL was provided limited funding in FY 2010 to archive valuable equipment and data related to non-electric applications of nuclear energy.

Nuclear Energy Enabling Technologies
SRNL provides support to the proliferation risk assessment activities under NEET.

Nuclear Hydrogen Initiative
SRNL coordinated hybrid sulfur thermochemical cycle R&D activities until the completion of the NHI program at the end of FY 2009.

Washington Headquarters
FY 2009, FY 2010, and FY 2011 include funding for SBIR and other small business initiatives. A potion of the funds allocated to Washington Headquarters will be competitively awarded for support of

both mission-specific and mission-related activities. Recipients may include industry, national laboratories, universities, research institutions.

Fuel Cycle Research and Development
HQ provides management of certain research activities and competitive solicitations.

Generation IV Nuclear Energy Systems
HQ provides overall oversight and management of R&D activities and serves as the interface with the NRC.

Idaho Facilities Management
Headquarters funds cross-cutting departmental activities such as DCAA audits, NRC certificates and fees, and NE's share of DOE corporate infrastructure management systems. Funding also supports NE-owned material storage fees at BWXT and waste generator fees at the Nevada Test Site.

International Nuclear Energy Cooperation
In FY 2011, INEC activities at headquarters include technical expertise in support of international bilateral and multilateral engagement and civil nuclear energy R&D with countries that are established as significant participants in the commercial nuclear sector; energy supply, nonproliferation and fuel cycle assessments; and reviewing the legal and financial liability implications of proposed strategies and options. Work may also include the creation of workshops to engage industry and foreign governments.

Nuclear Energy Enabling Technologies
In FY 2011, HQ will provide oversight of a competitively-awarded modeling and simulation Hub for the development of validated advanced modeling and simulation tools through their application to an existing, operating reactor.

Nuclear Hydrogen Initiative
MPR is a highly regarded technical services company in the commercial nuclear industry. In FY 2009, MPR provided independent technical reviews of NHI deliverables.

Nuclear Power 2010
Includes funding for closing out activities on the NuStart combined Construction and Operating License demonstration project.

Radiological Facilities Management
In FY 2011, the Department plans to initiate a project to restart the production of Pu-238 for the Space and Defense program. Activities will include: National Environmental Policy Act (NEPA) documentation and other safety and design actions necessary to meet the DOE O 413.3A requirements to obtain CD-1 in early FY 2011.

Reactor Concepts Research, Development and Demonstration
HQ provides overall management of reactor research and development activities and serves as the primary interface with the NRC. HQ develops competitive solicitations and industry cost-sharing arrangements to support Small Modular Reactors, NGNP, and other reactor concepts.

Integrated University Program

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Integrated University Program	5,000	0	5,000	0

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriations Act (2009)
P.L. 111-85, Appropriations Act (2010)

Mission

In FY 2009, the Integrated University Program provided fellowship grants and investigator-initiated research and development (R&D). In FY 2010, the Program provided scholarship and fellowship grants to support nuclear science and engineering research. No funding is being requested for this program in FY 2011.

Commencing in FY 2011, the Department's energy technology education efforts will be focused through its Regaining ENERGY Science and Engineering Edge (RE-ENERGYSE) program, a broad educational effort that cuts across program offices to inspire students and workers to pursue careers in science, engineering, and entrepreneurship related to energy. The Office of Nuclear Energy (NE) will be supporting the initiative through competitive awards at universities and educational research institutions focused on advancing nuclear energy technologies.[a]

Benefits

In order to leverage educational support efforts conducted elsewhere in the Department and to avoid duplication of these efforts, nuclear energy-related fellowships and scholarships will be funded through NE's support of the Department's RE-ENERGYSE program starting in FY 2011. In FY 2010, the Integrated University Program will provide approximately 30 three-year fellowships and 88 one-year scholarships. 100 percent of funding for multi-year awards is included within the FY 2010 appropriation.

Annual Performance Results and Targets

The Integrated University Program has contributed to the Secretary's Goal of *Innovation: Lead the World in Science, Technology, and Engineering* and to the National Nuclear Infrastructure GPRA Unit Program Goal. The program has supported nuclear energy R&D conducted at laboratories and universities across the Nation, as well as university nuclear engineering programs through scholarships and fellowships.

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[a] In FY 2011 the Office of Nuclear Energy (NE) will provide funding through RE-ENERGYSE for scholarships and fellowships. This activity will be coordinated with RE-ENERGYSE activities funded within the Office of Energy Efficiency and Renewable Energy (EERE). NE and EERE funds are requested in separate accounts; RE-ENERGYSE funds requested within NE will only support nuclear technology education.

Means and Strategies

The Integrated University Program has used various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

To end the program in FY 2010, the Department will implement the following means:
- Provide scholarships and fellowships as directed by statutory requirements.

To end the program in FY 2010 the Department will implement the following strategies:
- Issue scholarship and fellowship grants according to statutory requirements in a manner that ensures awards are fully funded within available FY 2010 funds.
- Follow the path set forth in FY 2009 to determine university needs and best categories of university grant investments to support nuclear science and engineering education.

These strategies will result in efficient and effective management of the program and productive use of the taxpayers' dollars.

In carrying out it's mission, the program performs the following collaborative activities:
- Coordinate with the NRC and the Defense Nuclear Nonproliferation (DNN) to support nuclear science and engineering education without duplication.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its support for university programs.

Integrated University Program

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Integrated University Program	5,000	5,000	0

Benefits

In order to leverage educational support efforts conducted elsewhere in the Department and to avoid duplication of these efforts, nuclear energy-related fellowships and scholarships will be funded through NE's support of the Department's RE-ENERGYSE program starting in FY 2011. In FY 2010, the Integrated University Program will provide approximately 30 three-year fellowships and 88 one-year scholarships. 100 percent of funding for multi-year awards is included within the FY 2010 appropriation.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Integrated University Program	**5,000**	**5,000**	**0**

In FY 2009, the Integrated University Program funded 9 three-year investigator-initiated nuclear science research projects and 3 three-year fellowships. In FY 2009, the scope of this program was planned in collaboration with the NRC and DNN programs.

In FY 2010, the Integrated University Program scope is focused entirely on supporting nuclear education by funding approximately 88 one-year scholarships and 30 three-year fellowships for students enrolled in nuclear energy-related fields of study or disciplines at U.S. universities and two-year colleges. 100 percent of funding for multi-year awards is included within the FY 2010 appropriation.

	FY 2009	FY 2010	FY 2011
Total, Integrated University Program	**5,000**	**5,000**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Integrated University Program In FY 2011, no funding is being requested for this program. The Department is undertaking a broad educational effort (RE-ENERGYSE) that cuts across DOE programs to coordinate, standardize, and evaluate Science, Technology, Engineering, and Mathematics education programs within DOE. Therefore, NE is requesting funding under the RE-ENERGYSE Initiative to support the continuation of nuclear energy-related education and research.	-5,000
Total Funding Change, Integrated University Program	**-5,000**

RE-ENERGYSE
(Regaining our Energy Science and Engineering Edge)

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
RE-ENERGYSE	0	0	0	5,000

Mission

The mission of RE-ENERGYSE (Regaining our Energy Science and Engineering Edge) is to provide the education and training necessary to build a highly skilled U.S. clean energy workforce dedicated to solving the world's greatest energy challenges.[a]

Benefits

RE-ENERGYSE supports scientific discovery and innovation at universities across the United States. This program will provide important educational support to bolster nuclear engineering and science programs at U.S. universities, which supports continued use of nuclear power. A robust nuclear industry and infrastructure will result in multiple benefits for our Nation: clean, secure energy supply and lower greenhouse-gas emissions.

Annual Performance Results and Targets

RE-ENERGYSE contributes to the Secretary's Goal of *Innovation: Lead the World in Science, Technology, and Engineering* and to the National Nuclear Infrastructure GPRA Unit Program Goal. RE-ENERGYSE supports university nuclear engineering programs through scholarships and fellowships. These fellowships will complement existing Federal efforts and will help ensure that the next generation of scientists and engineers are available to support existing and future nuclear energy generation capacity and provide necessary innovation.

Means and Strategies

RE-ENERGYZE will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

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[a] In FY 2011, the Office of Nuclear Energy (NE) will provide funds through RE-ENERGYSE for scholarships and fellowships. This activity will be coordinated with RE-ENERGYSE activities funded within the Office of Energy Efficiency and Renewable Energy (EERE). NE and EERE funds are requested in separate accounts to be consistent with appropriated intent; RE-ENERGYSE funds requested within NE will only support nuclear technology education.

The Department will implement the following means:
- Provide scholarships and fellowships to support nuclear engineering university programs through RE-ENERGYSE.

The Department will implement the following strategies:
- Strategically plan and implement activities by coordinating with experts in education, the Department of Energy's (DOE) Office of Science, the Department of Labor, the Department of Education, the National Science Foundation (NSF), and the American Academy of Community Colleges, to ensure that this program fills educational gaps and does not duplicate efforts;
- Leverage the capacity of universities, the DOE National Laboratories, educational foundations, and industry to offer educational and research opportunities that will make a critical difference in informing and inspiring students to pursue careers in clean energy;
- Reach out broadly to universities, community colleges, and other relevant institutions to encourage widespread involvement of diverse communities, as well as constructive competition to stimulate the development of outstanding programs;
- Develop the outreach infrastructure necessary to communicate and disseminate curricula and other programs materials and importantly enable collaboration and feedback;
- Issue competitive solicitations to ensure that high quality institutions have the means and interest to create and sustain education and training efforts;
- Dedicate up to 10 percent of each subprogram for metric driven program evaluation activities and peer reviews;
- Create energy-specific materials at the school grade K-12 levels to engage, excite, and educate;
- Provide direct channels feeding energy-accredited and up-to-date materials into K-12 schools and communities; and
- Attract qualified candidates to competitive higher education programs.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

In carrying out the program's mission, the program performs the following collaborative activities:
- Work closely with RE-ENERGYSE to implement the means and strategies and ensure a well coordinated, efficient, effective program.

Validation and Verification

The NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its Research and Development (R&D) and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts RD&D and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques. NE will work closely with RE-ENERGYSE verify and validate the impacts of the program through a variety of means, such as assembling an expert panel to review and accredit program materials, using effective performance and effectiveness evaluation processes, and conducting workshops to inform priorities. A wide range of education and science organizations (e.g., NSF, National Center for Education Statistics, National Science Board, Department of Education, and National Science Teachers Association) will be consulted to provide data for the development of program priorities.

RE-ENERGYSE

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RE-ENERGYSE	0	0	5,000

Benefits

NE is providing funds for scholarships and fellowships through RE-ENERGYSE to support the development of future nuclear researchers, scientists, and engineers. Strengthened university nuclear programs will help support the Nation's current and future nuclear energy needs.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
RE-ENERGYSE	**0**	**0**	**5,000**
In FY 2011, the RE-ENERGYSE program plans to fund approximately 88 one-year scholarships and 30 three-year fellowships to students enrolled in nuclear energy-related fields of study of disciplines at U.S. universities and two-year colleges.			
Total, RE-ENERGYSE	**0**	**0**	**5,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
RE-ENERGYSE	
In FY 2011, new funding is being requested for this program to support the Department's broad educational effort that cuts across DOE programs to coordinate, standardize, and evaluate Science, Technology, Engineering, and Mathematics education programs.	+5,000
Total Funding Change, RE-ENERGYSE	**+5,000**

Nuclear Power 2010
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Nuclear Power 2010	177,500	0	105,000	0

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)
P.L. 111-85, Appropriation Act (2010)

Mission

The Nuclear Power 2010 (NP 2010) program is a joint government/industry cost-shared effort established in 2002 to demonstrate untested NRC regulatory and licensing processes. The program will accomplish its intended purpose in FY 2010 and will be brought to conclusion.

Benefits

The NP 2010 program has provided funding to industry to achieve notable milestones including the issuance of three NRC-approved Early Site Permits (ESP), which establish that a site is suitable for possible future construction and operation of a nuclear power plant, and the submission to the NRC of two construction and operating license (COL) applications for two reactor designs. In addition, the program has placed the certification of the AP 1000 and Economic Simplified Boiling Water Reactor (ESBWR) reactor designs on a successful path to completion. The program has promoted industry interest in the deployment of the first new nuclear plants in 30 years[a] and will enable industry to make decisions to build plants in 2010. The NP 2010 program will achieve a prioritized set of its performance goals on one licensing project in FY 2010.

Annual Performance Results and Targets

The NP 2010 program's performance measure aligned to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the GPRA Unit Program Goal of New Nuclear Generation Technologies. The performance measure aligned to these goals by tracking progress on supporting industry in completing COL and design certification efforts. FY 2010 will be the final year for tracking this performance measure.

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[a] To date industry has submitted a total of 17 COL applications to NRC covering 26 new nuclear reactors: http://www.nrc.gov/reactors/new-reactors/new-licensing-files/expected-new-rx-applications.pdf

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: New Nuclear Generation Technologies

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**
Efficiency Performance Measure: *Maintain total administrative overhead costs in relation to total R&D program costs of less than 8 percent.*									
T: <8% A: Met	T: <8% A: Met	T: <8% A: Met	T: <8% A: Met	T: <8% A:	T: NA A:	T: NA A:	T: NA A:	T: NA A:	T: NA A:
FY 2010: Enable industry to make a decision to build a new nuclear power plant by 2010 by continuing to support the completion of construction and operating license and design certification efforts. FY 2009: Enabled industry to make a decision to build a new nuclear power plant by 2010 by supporting New Nuclear Plant Licensing Demonstration Projects within the planned scope, schedule, and budget of the program, and by administering the Department's standby support program. FY 2008: Enabled industry to make a decision to build a new nuclear power plant by 2010 by supporting New Nuclear Plant Licensing Demonstration Projects and by administering the Department's standby support program. FY 2007: Completed NP 2010 engineering and licensing activities, focusing on the resolution of reactor certification and design issues and the preparation and review of Construction and Operation License (COL) applications, to enable an industry decision in 2010 to build a new nuclear power plant. FY 2006: Completed engineering and licensing demonstration activities necessary to implement the NP 2010 program in accordance with the principles of project management, to help ensure that program performance goals are achieved on schedule and within budget.									
T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A:	T: NA A:	T: NA A:	T: NA A:	T: NA A:	T: NA A:

Means and Strategies

As the program is closed out in FY 2010, it will use various means and strategies to continue to achieve its GPRA Unit Program goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

As the program is brought to closure in FY 2010, the Department will implement the following means:

- Close out joint government/industry cost-shared effort to support one combined COL for the NuStart Consortium.

As the program is brought to closure in FY 2010, The Department will implement the following strategies:

- Close out all partnerships with the private sector, national laboratories, universities, and international partners to support advanced Light Water Reactor (LWR) technologies.
- Lead the international community in pursuit of advanced LWR technologies (Generation III+) that will benefit the United States with enhanced safety and improved economics.

These strategies and other efforts will result in the efficient and effective management of the program, thus putting the taxpayer's dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Ultimately, the decision to build new nuclear power plants rests with industry alone. This decision depends in part on power demand and economic and environmental factors beyond the scope of the Department's research and development (R&D) programs. In the near term, it depends on complex economic decisions made by industrial partners.

In carrying out the program's mission, the Office of Nuclear Energy (NE) performs the following collaborative activities:

- In FY 2010, the Department will work with industry to wrap up remaining activities and close out cost-shared partnerships established under NP 2010 originally to conduct demonstrations of untested Federal regulatory and licensing processes.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts Research, Development and Demonstration and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals.

NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences.

Nuclear Power 2010

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Nuclear Power 2010			
Cost-shared Program with Industry	177,000	105,000	0
Standby Support Program	500	0[a]	0
Total, Nuclear Power 2010	177,500	105,000	0

Benefits

The NP 2010 program has provided funding to industry to achieve planned milestones including the issuance of three NRC-approved ESP, which establish that a site is suitable for possible future construction and operation of a nuclear power plant, and the submission to the NRC of two COL applications for two reactor designs. The program has promoted industry interest in the deployment of the first new nuclear plants in 30 years[b] and will enable industry to make decisions to build plants in 2010. The NP 2010 program will achieve a prioritized set of its performance goals on one licensing project in FY 2010.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Cost-shared Program with Industry	**177,000**	**105,000**	**0**

As part of the program's cost-shared efforts, NP 2010 has supported technology engineering and design for Generation III+ advanced LWRs. These new designs offer advancements in safety and economics over the Generation III designs licensed or certified previously by the NRC. To reduce the regulatory uncertainties and, thereby, enable the deployment of new nuclear power plants in the United States, the program helped demonstrate the untested Federal regulatory processes for the new plant siting (called ESP), and construction and operation of new nuclear plants (called combined COL), and design certification.

To demonstrate the untested regulatory process for obtaining NRC approval for constructing and operating new nuclear power plants, in FY 2005 the Department established competitively selected, cost-shared cooperative agreements with industry teams. Additionally, the agreements originally included the completion of design certification and detailed standardized plant designs for Westinghouse's AP 1000 and General Electric Hitachi's (GEH) ESBWR. By the end of FY 2010, all on-going design certification and COL project activities will be completed. The program will have fully achieved its goals and industry will have more than sufficient information and incentive to proceed on its own. Proof of this success is evident in the work that is currently being performed for the first domestic AP 1000 nuclear plant at Southern Company's Vogtle site under an NRC Limited Work Authorization.

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[a] Standby Support Program funding moves to the program direction account in FY 2010.

[b] To date industry has submitted a total of 17 COL applications to NRC covering 26 new nuclear reactors: http://www.nrc.gov/reactors/new-reactors/new-licensing-files/expected-new-rx-applications.pdf

In FY 2009, the project teams (NuStart, Dominion, GEH, and Westinghouse) continued activities with NRC to resolve COL application questions. Resolution resulted in issuance of Safety Evaluation Reports and Environmental Impact Statements (EIS) by the NRC. Reactor vendor activities continued to focus on design certification for the AP 1000 and ESBWR standard plant design.

In FY 2009, the Department:

- Continued industry interactions with NRC on the ESBWR and the AP 1000 reference COL applications including responses to NRC Request for Additional Information, meetings with the Advisory Committee on Reactor Safety (ACRS), and issuance of Safety Evaluation Reports (SER) and Draft EIS.
- Resolved open AP 1000 amended and ESBWR certification items to allow the NRC to issue SERs for design certification.
- Continued First-of-a-Kind Engineering design finalization activities for the standardized AP 1000 and design and preparation of the engineering analyses and calculations, design criteria documents, and design technical information.
- Accelerated standard AP 1000 design finalization activities necessary to complete vendor component/equipment procurement specifications and allow the utilities to issue contracts to initiate fabrication of modular plant components and other long lead equipment.

In FY 2010, the Department is:

- Providing final funding for the design finalization of the AP 1000 technology, design certification of the ESBWR technology, and close-out work on the NuStart COL reference application to complete support of industry interactions with NRC on the NuStart COL application including meetings with the ACRS, issuance of the Final Safety Evaluation Report and the Final EIS, and initiating hearings by the Atomic Safety Licensing Board.

Supporting one application project in FY 2010 will provide sufficient support for industry decisions to deploy new nuclear plants. By FY 2010, sufficient momentum will have been created by the cost-shared programs that all partners will have adequate incentive to complete any additional work through private funding and sufficient work will have been completed to demonstrate the new NRC design-centered licensing approach.

	FY 2009	FY 2010	FY 2011
Standby Support Program	**500**	**0**	**0**

Standby Support is a form of insurance protection from certain delays in nuclear plant operation beyond the control of the power company owner. In FY 2010 and FY 2011, the Department will fund staff to perform related analyses and modeling as appropriate.

In FY 2009, the Department:

- Reviewed requests for conditional agreements from sponsors of new nuclear power plants.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
- Updated cost models and underlying analyses by working with financial and technical subject matter experts to support the development of estimated costs for individual requests.			
Total, Nuclear Power 2010	**177,500**	**105,000**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Cost-shared Program with Industry The decrease from $105,000 to $0 results from conclusion of the program.	-105,000
Total Funding Change, Nuclear Power 2010	-105,000

Generation IV Nuclear Energy Systems
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Generation IV Nuclear Energy Systems	178,649	0	220,137	0[a]

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)
P.L. 111-85, Appropriation Act (2010)

Mission

Beginning in FY 2011, all Generation IV Nuclear Energy Systems (Gen IV) program activities will be carried out under the new Reactor Concepts Research, Development, and Demonstration (RD&D) program. The mission of the Gen IV activities is to address critical unanswered questions about advanced nuclear reactor technologies through research and development (R&D) to help meet tomorrow's needs for reliable electricity production and non-traditional applications of nuclear energy.

Benefits

Through scientific R&D and international collaboration, Gen IV supports the R&D of next-generation nuclear reactor technologies that could result in improved performance in sustainability, safety, economics, security, and proliferation resistance.

Annual Performance Results and Targets

Gen IV's performance measure aligned to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the GPRA Unit Program Goal of New Nuclear Generation Technologies. The performance measure aligned to these goals by tracking progress on milestones that must be met to inform the Secretarial decision on whether to proceed with the Next Generation Nuclear Plant (NGNP) project. The NGNP is being developed for economical production of electricity and other desirable products derived from high quality heat, which may increase contributions from nuclear energy to greenhouse gas abatement efforts. In FY 2011, Nuclear Energy (NE) will continue to track progress on the NGNP performance measure under the Reactor Concepts RD&D program.

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[a] FY 2011 funding is requested in the Reactor Concepts Research, Development and Demonstration budget.

Means and Strategies

As the Gen IV program is incorporated into the Reactor Concepts RD&D program in FY 2011, it will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Continue R&D on advanced, next-generation reactor systems that offer the most sustainable, cost-competitive, reliable, and secure means of generating electricity including participation by the national laboratories, industry, and university research communities as well as the international research community represented by the Generation IV International Forum (GIF).
- International cost sharing is in place for the R&D on Gen IV technologies under the GIF reactor technologies and industry cost-sharing will be pursued for the design and the construction of the NGNP at the Idaho National Laboratory (INL).

The Department will implement the following strategies:

- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- Programs will also engage the international community in pursuit of advanced nuclear technology that will benefit the United States with enhanced safety, improved economics, and reduced production of wastes.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Deploying new nuclear power is ultimately an industry decision. Whether new nuclear plant technology is deployed depends on power demand and economic and environmental factors beyond the scope of DOE R&D programs. In the near term, it depends on complex economic decisions made by industrial partners.
- Industry is inclined to focus on near-term deployment using proven technologies. Industry may not immediately support or be supportive of longer-term development of better technologies.
- All nuclear energy research programs rely heavily on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, U.S. efforts would need to be re-evaluated.

In carrying out the program's mission, the program performs the following collaborative activities:

- The program will support ongoing international collaboration on Sodium Fast Reactor (SFR) technology, to include fuel and material development and reactor design.
- The Department and the NRC coordinate program planning to assure that their R&D activities are complementary, cost effective, and not duplicative.
- The program is receiving broad international cooperation and support, consistent with the objectives of the program. The GIF, composed of representatives from 12 governments and the European Union, provides guidance for executing R&D activities focused on these next-generation nuclear energy systems.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts RD&D and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders in a number of recent evaluation activities to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences.

Generation IV Nuclear Energy Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Generation IV Nuclear Energy Systems			
Generation IV R&D	1,956	28,321	0
Next Generation Nuclear Plant R&D	176,693	164,268	0
Energy Innovation Hub for Modeling and Simulation	0	21,384	0
SBIR/STTR	0	6,164	0
Total, Generation IV Nuclear Energy Systems	178,649	220,137	0

Benefits

Beginning in FY 2011, all Gen IV program activities will be carried out under the new Reactor Concepts RD&D program. This new program consolidates reactor related R&D to improve information sharing, minimize duplication, and increase transparency. Gen IV activities provide technical advancements and anticipated benefits including creating an international network of user facilities for nuclear R&D, and reduce the technical uncertainties to support the deployment of new nuclear reactor technologies. These advancements will help nuclear energy to compete economically with other technologies.

NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to supporting R&D activities at university and educational research institutions, NE programs competitively award funds that support both mission-specific and mission-related activities. NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects. Further, the national laboratories are encouraged to partner with universities to conduct R&D.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Generation IV R&D	**1,956**	**28,321**	**0**

In FY 2011, Gen IV R&D will be executed under the Reactor Concepts RD&D program. In FY 2010, the Gen IV R&D program focuses on crosscutting R&D in materials science and in codes and methods. Also in FY 2010, Congress appropriated $10,000,000 for R&D activities to support Light Water Reactor (LWR) life extension activities. Gen IV R&D activities are coordinated with foreign researchers through GIF and with the DOE Office of Science. Gen IV R&D also includes an examination of supercritical carbon dioxide as a working fluid for a more efficient method of producing electricity. R&D to support a domestic SFR prototype reactor has been discontinued. Longer term R&D on Gen IV reactor concepts, including the SFR, with international GIF partners will continue. Finally, Gen IV R&D provides secretariat support for the international policy and

	(dollars in thousands)	
FY 2009	FY 2010	FY 2011

experts groups of the GIF and supports the establishment of common evaluation methodologies of economics, safety, and proliferation resistance and physical protection of Gen IV reactors.

In FY 2009, the Department:
- Developed the fundamental scientific basis to understand, predict, and measure changes in materials, systems, structures, and components as they age.
- Applied this fundamental knowledge in collaborative public-private partnerships to develop and demonstrate methods and technologies that support safe and economical long-term operation of existing LWRs. Researched new technologies to address enhanced plant performance, economics, and safety.

In FY 2010, the Department is:
- Continuing development of advanced materials, such as oxide dispersion strengthened, alloys for use in structural system, fuel claddings and high temperature applications.
- Completing initial testing (mechanical, creep fatigue, thermal aging) of structural alloy candidate materials.
- Developing design methodology for long-term materials performance.
- Incorporating reactor core structural models into advanced reactor simulation methods.
- Performing validation studies for advanced reactor simulation methods.
- Continuing efforts on advanced modeling techniques utilizing the Department's high-speed, parallel computers for the development of close-coupled neutronic and thermofluid codes.
- Continuing R&D on the technical and economic viability of an advanced Brayton-cycle energy conversion system using supercritical carbon dioxide as the working fluid.
- Continuing phenomenology testing (e.g., sodium plugging) for compact heat exchangers.
- Participating in the work of the Proliferation Resistance and Physical Protection Working Group.
- Participating in the Economics Modeling and Reliability and Safety Working Groups.
- Investing in research aimed at revolutionary improvements to LWR technology.
- Performing reviews of innovative and novel reactor concepts for potential future R&D support.
- Providing critical Secretariat and meeting facilitation support for two international policy group and two international expert group meetings.

In FY 2011, funding for Gen IV R&D and LWR Sustainability activities are requested in the Reactor Concepts RD&D budget. Funding for new crosscutting technology activities is requested in the Nuclear Energy Enabling Technologies budget.

Next Generation Nuclear Plant	**176,693**	**164,268**	**0**

The Department's NGNP program collaborates with industry and other governmental organizations to conduct activities necessary to demonstrate a gas-cooled reactor technology in the United States. This includes development of a licensing strategy with the NRC, design, and R&D sufficient to support a licensing application submittal to the NRC. This project covers a range of activities from R&D to construction that are subject to cost-sharing requirements outlined in section 988 of EPAct 2005. Near-term emphasis is on results that will support key decisions by the Secretary of Energy on the future of the program. Important considerations include the availability of a licensable fuel for the reactor, qualification of nuclear grade graphite, design of high project-risk components such as steam-generators and heat exchangers, the form and content requirements for a gas-cooled reactor licensing application, and other factors.

In FY 2010, the Department will cost-share with industry to complete the conceptual design of the NGNP. The Department continues to work with the U.S. private sector to identify industrial end-user requirements, produce trade studies reviewing the potential for integrating NGNP into various industrial applications. Similarly, the Department's collaboration with the NRC is supporting the development of a framework for licensing gas-cooled reactors in the United States. Key issues include the establishment of gas-cooled reactor specific requirements for emergency planning zones, containment design, and the quantification of potential radioactive releases. Finally, the Department is working with universities, national labs and the international community to develop analytical tools and conduct tests on fuel, metals and graphite to support the data needs of the reactor designers, regulators, and end-users. The INL coordinates NGNP R&D on behalf of the Department.

In FY 2009, the Department:

- Continued to successfully irradiate TRistructural ISOtropic coated gas reactor particle fuel in the INL Advanced Test Reactor (ATR) as part of the Advanced Gas Reactor (AGR-1) test.
- Completed the design of the test train for simulating severe fuel damage.
- Completed the Advanced Graphite Creep (AGC-1) test train and attained ready to insert status for the ATR testing of nuclear grade graphite.
- Continued the support of industry code committees in qualifying high-temperature materials and analytical methods.
- Worked collaboratively with NRC on high temperature gas reactor licensing technical issues including required R&D, Quality Assurance, containment and emergency planning issues, many of which are generically applicable to other advanced reactor concepts.
- Completed environmental experiments and mechanical property tests for potential IHX alloys.
- Completed test plan for water-cooled Reactor Cavity Cooling System experiments in Natural Convection Shutdown Heat Removal Test Facility at Argonne National Laboratory (ANL).
- Continued conceptual design activities for high project-risk systems and components.
- Issued a Funding Opportunity Announcement to partner with industry on the development of conceptual designs for NGNP.
- Continued analytical method and code development for benchmarking pebble-bed and prismatic cores in both physics and heat transport.
- Conducted cost-shared research in GIF Very High Temperature Reactor (VHTR) Projects for Design, Safety, and Integration; Computational Methods and Benchmarks; Materials; and Fuel and Fuel Cycle.
- Continued international collaborative projects on composites and high-temperature metallic materials testing, thermal-hydraulic analyses and experiments, and zirconium-carbide fuel particle coatings.
- Continued advanced modeling techniques utilizing the Department's high-speed, massively parallel computers for the development of close-coupled neutronic and thermofluid codes.

- Continued, in collaboration with international partners, the development of crosscutting benchmarking methodologies (economics, proliferation resistance and physical protection, and reactor safety).
- Maintained the *Generation IV Materials Handbook* to support code case development and arranged for other GIF organizations to contribute new materials data and access to all data.
- Continued collaboration with France on nano-structured ferritic alloys and initiated collaborative projects with France and the Republic of Korea on mechanical and corrosion testing of nickel-based alloys for VHTR applications and thermal-hydraulic analyses and experiments for VHTR safety.
- Continued collaboration with Japan on zirconium-carbide fuel particle coatings.
- Co-chaired the GIF VHTR Steering Committee and provided critical Secretariat and meeting facilitation support for two GIF Policy Group and two GIF Expert Group meetings.

In FY 2010, the Department is:

- Cost-sharing with industry to complete the conceptual design of one or two gas-cooled reactor concepts for the NGNP. In addition to conceptual design, industry partners will update project cost and schedule estimates and develop business plans for financing and managing the final design, licensing, and construction of the NGNP.
- Continuing advanced modeling techniques utilizing the Department's high-speed, parallel computers for the development of close-coupled neutronic and thermofluid codes.
- Maintaining the *Generation IV Materials Handbook* and arranging for other international partner organizations to share existing data and add new materials data.
- Commencing irradiation in the INL ATR of the first VHTR fuel produced in commercial scale production equipment (AGR-2).
- Preparing for and performing post-irradiation examination of the AGR-1 fuel removed from the ATR.
- Irradiating the first AGC-1 test experiment to provide data for nuclear graphite qualification.
- Continuing mechanical and chemical property characterization of high-temperature metals.
- Establishing an NRC approved Appendix B quality assurance program for all work performed on gas-cooled reactors that is related to design or licensing of future commercial gas-cooled reactors.
- Continuing development of national and international consensus codes and standards, including the qualification of high-temperature materials and the development of analytical methods.
- Preparing documentation on the technical and economic benefits and challenges of co-generation energy systems.
- Collaborating with NRC on scale reactor tests to be performed at Oregon State University and at ANL to benchmark thermal-fluid reactor system modeling tools.
- Submitting white papers to NRC on key licensing topics and respond to their review comments, topics include "Defense in Depth," "High Temperature Materials," "Fuel Qualification," and "Mechanistic Source Term."

In FY 2011, funding is requested in the Reactor Concepts RD&D budget.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Energy Innovation Hub for Modeling and Simulation	**0**	**21,384**	**0**

The national priorities for NE include working with industry and the existing reactor fleet to safely uprate power and to extend the reactors operating life. In addition, NE undertakes R&D to advance new nuclear energy technologies. This includes the Generation III+ and IV reactor systems as well as the development of small modular reactors. Advanced modeling and simulation is an essential tool to improving our scientific understanding of these systems to safely increase the pace of innovation and reduce costs.

One of the greatest challenges facing the designers and engineers for the Generation III+ and Generation IV reactors in using advanced modeling and simulation is the "user interface" required to access greater computing power. The current user interface for these tools and computers was created for work in the discovery sciences domain; a domain characterized by a small number of highly educated users, running a limited number of jobs for long periods on very powerful computers. In contrast, the applied domain of designers and engineers is characterized by a large variety of users running a plethora of jobs for short periods on very low power computers (e.g. desktops).

The focus of the Energy Innovation Hub for Modeling and Simulation (Hub) will be on dramatically changing the user environment for advanced modeling and simulation and high performance computing. The result will increase the pace of innovation, lower costs, and reduce uncertainty and risk for the design of reactors. The Hub will integrate and simplify the use of a wide range of technologies needed to use high performance advanced modeling and simulation by employing a cross-disciplinary team of nuclear engineers and scientists, computer scientists, mathematicians, verification and validation experts and sociologists and psychologists.

To achieve the highest degree of success the Hub will be mission driven. The mission focus of the Hub is to create a "virtual" model of an operating reactor with the potential coupling of a physical reactor for validation and verification purposes. This will involve the use of existing appropriate capabilities, the integration of existing and new modeling and simulation capabilities via an interoperability framework, the development of additional modeling and simulation capabilities as needed, and the validation of the capabilities using data obtained from the operating reactor. This will allow the creation of advanced user environments to provide interface with the virtual model. Also, where needed, the Hub will develop new 3D science based modeling and simulation capacities that are usable on advanced computing architectures. The Hub will also provide opportunities for fundamental and applied research that will combine experiments, theory and modeling and simulation to better understand nuclear energy technologies. The exact scope of work to be performed by the Hub will, however, be defined by the successful applicant.

To achieve the highest degree of success the Hub will be mission driven. The mission focus of the Hub is to create a "virtual" model of an operating reactor with the potential coupling of a physical reactor for validation and verification purposes. This will involve the use of existing appropriate capabilities, the integration of existing and new modeling and simulation capabilities via an interoperability framework, the development of additional modeling and simulation capabilities as needed, and the validation of the capabilities using data obtained from the operating reactor. This will allow the creation of advanced user environments to provide interface with the virtual model. Also, where needed, the Hub will develop new 3D science based modeling and simulation capacities that are usable on advanced computing architectures. The Hub will also provide opportunities for fundamental and applied research that will combine experiments, theory and modeling and simulation to better understand nuclear energy technologies. The exact scope of work to be performed by the Hub will, however, be defined by the successful applicant.

The Hub will accelerate the validation of modeling and simulation of nuclear energy technologies, develop advanced approaches to demonstrate the "predictability" of advanced modeling and simulation, and implement advanced instrumentation to observe the operation of physical nuclear energy technologies. A great deal of work has been accomplished or is currently underway to build, verify, and validate the modeling and simulation capabilities needed for nuclear energy. The Hub will serve a valuable and unique role that supplements this work by focusing on an existing reactor, focusing on engineering "usability issues" for advanced modeling and simulation, and allowing an opportunity for national laboratories, universities, and industry to work in a highly collaborative environment focused on a single mission.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

The Department anticipates that the benefits of the Hub will extend to all other forms of energy. The same user environment needed by nuclear energy technology designers and engineers will be usable by other energy technologies (e.g. solar, wind, and biomass energy systems). The user environment has the potential to transform advanced modeling and simulation applied to traditional forms of energy such as coal, natural gas, and petroleum as well.

In FY 2010, the Department is:

- Competitively establishing the Hub.
- Developing and issuing a Funding Opportunity Announcement.
- Preparing to select an applicant and award of a Cooperative Agreement contract for five years with the possibility of a five year extension if a high standard of performance is achieved.

Once the contract is awarded, the Department-funded Hub will:

- Proceed to establish the Hub to provide the deliverables and achieve the goals and objectives presented in the winning proposal.
- Staff the Hub with subject matter experts for required core capabilities and relocate personnel as needed for optimum Hub operating efficiency.
- Prepare the Hub infrastructure including any required renovation of existing buildings, leasing buildings, purchase of research equipment and instrumentation, and installation of state-of-the-art Hub communications and interface capabilities for long distance collaboration.
- Initiate robust interaction with private industry for the collection of requirements from expected users of the nuclear energy engineering environment.

In FY 2011, funding is requested in the Nuclear Energy Enabling Technologies (NEET) budget.

	FY 2009	FY 2010	FY 2011
SBIR/STTR	**0**	**6,164**	**0**

The FY 2010 amount shown is an estimated requirement for the continuation of the SBIR and STTR program.

	FY 2009	FY 2010	FY 2011
Total, Generation IV Nuclear Energy Systems	**178,649**	**220,137**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Generation IV R&D The decrease from $28,321,000 to $0 reflects the transfer of activities to the Reactor Concepts RD&D and NEET budgets.	-28,321
Next Generation Nuclear Plant R&D The decrease from $164,268,000 to $0 reflects the transfer of activities to the Reactor Concepts RD&D budget.	-164,268
Energy Innovation Hub for Modeling and Simulation The decrease from $21,384,000 to $0 reflects the transfer of activities to the NEET budget.	-21,384
SBIR/STTR The decrease from $6,164,000 to $0 reflects the transfer of R&D expenditures subject to SBIR and STTR to the Reactor Concepts RD&D and NEET.	-6,164
Total Funding Change, Generation IV Nuclear Energy Systems	**-220,137**

Reactor Concepts Research, Development and Demonstration
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Reactor Concepts Research, Development and Demonstration	0	0	0	195,000

Mission

The mission of the Reactor Concepts Research, Development and Demonstration (RD&D) program is to develop new and advanced reactor designs and technologies that advance the state of reactor technology to broaden its applicability, improve its competitiveness, and ensure its lasting contribution in meeting our nation's energy and environmental challenges. RD&D activities carried out by the program are designed to address technical, cost, safety, and security issues associated with reactor concepts, including Small Modular Reactors (SMRs), the Next Generation Nuclear Plant Demonstration Project (NGNP), and other advanced reactor concepts. In addition, the program will develop advanced technologies that will support extending the life of existing Light Water Reactors (LWRs). Nuclear Energy (NE) will leverage innovative, crosscutting research and development (R&D) activities carried out by the Nuclear Energy Enabling Technologies (NEET) program, complementing the RD&D carried out in this program.

Benefits

Through scientific research at pre-eminent national laboratories, collaboration with universities and international research agencies, and competitive cost-shared RD&D with industry, nuclear power can expand both domestically and internationally, providing a clean, safe, secure, affordable and abundant source of energy. However, to maximize the benefits of nuclear power, work must be done to address technical, cost, safety, and security challenges.

These challenges include:
- Improving the affordability of nuclear energy;
- Addressing the management of nuclear waste; and
- Minimizing proliferation risks of nuclear materials.

The four elements within the Reactor Concepts RD&D program will help address these challenges. Research into SMRs can improve the affordability of nuclear power making it more appealing to owners and investors because of the potential to reduce capital costs. The NGNP will help demonstrate the technical viability of co-generation by providing electricity and carbon-free, high-temperature process heat for a variety of industrial uses. The Light Water Reactor Sustainability (LWRS) research will help provide a technical basis for the long-term safety and reliability of the current nuclear power fleet beyond 60 years. Without this life extension, the current fleet will begin to shutdown in 2029 and will offset any increases in clean energy generation from newly constructed plants. Research into other advanced reactor concepts may improve the sustainability of nuclear energy in a variety of ways, including improving the nuclear fuel cycle and nuclear waste management. Innovative reactor concepts offer the potential to further reduce capital and operating costs, improve performance, enhance safety, and minimize the risk of proliferation. These activities will enable nuclear power to continue to be a key component of our energy portfolio and help to achieve the energy security and greenhouse gas (GHG) emission reduction objectives of the United States.

Annual Performance Results and Targets

The Reactor Concepts RD&D program's performance measures align to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the GPRA Unit Program Goal of New Nuclear Generation Technologies. The NGNP performance measure aligns to these goals by tracking progress on milestones that must be met before proceeding with construction and demonstration of a Very High Temperature Reactor (VHTR). The LWRS performance measure aligns to the Secretary's goal by tracking R&D activities on component and material aging and degradation for existing nuclear power plants. These activities will directly benefit existing plants by extending their current operating licensing period. By extending the life of existing reactors, these activities contribute to GHG abatement efforts.

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: New Nuclear Generation Technologies

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**
FY 2011 Efficiency Performance Measure: *Maintain total administrative overhead costs in relation to total R&D program costs of less than 8 percent.*									
T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:
NGNP FY 2011 Effectiveness Performance Measure: Determine a path forward for the design and construction of a next generation nuclear power plant by 2011 by partnering with private industry on the development of NGNP, performing environmental assessment activities, and continuing with the research, analysis, design, and licensing activities to establish the basis for determining whether the project should continue to Phase 2. FY 2010: Support the Nuclear Energy Advisory Committee's (NEAC) evaluation of ongoing R&D and identification of future R&D and other activities needed. Additional performance measures and targets are under development. FY 2009: Continued the research, analysis and conceptual design activities needed to identify preferred alternative technologies for reactor systems, including examination of fuel and moderator materials. FY 2008 Determined a path forward for the design and construction of a next generation nuclear power plant by 2011 by submitting an NGNP licensing strategy to Congress and completing NGNP conceptual design technology selection studies. FY 2007 Completed Generation IV (Gen IV) activities, focusing on fuels and materials testing and plant system optimization, to inform the functional and operational design requirements of a next generation of nuclear power plant by FY 2011. FY 2006: Completed Gen IV R&D activities to inform a design selection for the next generation nuclear power plant by FY 2011.									
T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:
Light Water Reactor Sustainability FY 2011 Effectiveness Performance Measure: Develop the scientific knowledge to extend existing nuclear plant operating life beyond the current 60 year limit and ensure their long term reliability, productivity, safety, and security by conducting R&D activities in partnership with national laboratories, industry, universities, and international partners. FY 2010: Develop the scientific knowledge to extend existing nuclear plant operating life beyond the current 60 year limit and ensure their long term reliability, productivity, safety, and security by conducting R&D activities in partnership with national laboratories, industry, universities, and international partners. (This measure is new starting in FY 2010.)									
T: none A: NA	T: none A: NA	T: none A: NA	T: none A: NA	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:

Means and Strategies

The Reactor Concepts RD&D program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Advanced, next-generation reactor systems that offer the most sustainable, cost-competitive, reliable, and secure means of generating electricity and high-temperature process heat are being developed by the Reactor Concepts RD&D program. The program includes participation by the national laboratories, industry, and university research communities as well as the international research community, including collaborations through the Generation IV International Forum (GIF).
- International cost sharing is in place for the R&D on some intermediate- and long-term reactor technologies and industry cost-sharing will be pursued for the design and the construction of the NGNP.
- The program will implement joint government/industry cost-shared R&D activities to establish the technical and licensing basis to extend the safe and economical operation of the existing nuclear plants to beyond 60 years. Laboratory R&D will be conducted to research, develop, and test high-performance LWR reactor fuel and clad materials to extend the operating cycles and enhance safety and productivity of existing nuclear plants and will be conducted with universities, industry, and national laboratories.
- The program will conduct R&D of innovative nuclear plant designs capable of achieving generation and performance demands currently not serviceable by large base load nuclear power plants. Solicit, competitively select, and award innovative nuclear plant design project(s) with industry partners.
- The program will leverage innovative, crosscutting R&D activities carried out by the NEET program, complementing the RD&D carried out in this program.
- The program will leverage capabilities developed by National Nuclear Security Administration and the Department of Energy's (DOE) Office of Science in modeling and simulation.

The Department will implement the following strategies:

- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- Programs will also engage the international community in pursuit of advanced nuclear technologies that will benefit the United States with enhanced safety, improved economics, and reduced production of wastes.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- Whether new nuclear plant technology is deployed depends on power demand and economic and environmental factors beyond the scope of DOE R&D programs. It depends on complex economic decisions made by industrial partners.
- Industry is inclined to focus on near-term deployment using proven technologies. Industry may not readily support or be supportive of longer-term development of better technologies.
- All nuclear energy research programs rely in part on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, an increased U.S. effort in technology development would be required.

In carrying out the program's mission, the program performs the following collaborative activities:

- Reactor Concepts RD&D will support international collaboration on various reactor concepts and coolants to include fuel and material development, systems and components.
- The Department will work with the NRC in program planning to assure that their R&D activities are complementary, cost effective, and not duplicative.
- The Reactor Concepts RD&D program is receiving broad international cooperation and support, consistent with the objectives of the program. These R&D activities are integrated, where possible, into GIF activities in order to better leverage U.S. funding.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include NEET and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders in a number of recent evaluation activities to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. NE considers input from a wide variety of sources and stakeholders in determining what activities it will undertake.

NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee (NEAC) and National Academy of Sciences.

Reactor Concepts Research, Development and Demonstration

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Reactor Concepts Research, Development and Demonstration			
Small Modular Reactors	0	0	38,880
Next Generation Nuclear Plant Demonstration Project	0	0	103,032
Light Water Reactor Sustainability	0	0	25,758
Advanced Reactor Concepts (formerly Generation IV Nuclear Energy Systems Research and Development)	0	0	21,870
SBIR/STTR	0	0	5,460
Total, Reactor Concepts Research, Development and Demonstration	0	0	195,000

Benefits

The primary mission of NE is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, and security issues, through RD&D. The Reactor Concepts RD&D program consolidates and integrates a variety of nuclear reactor technology initiatives to support this mission.

The Reactor Concepts RD&D program includes the following program elements:

- Small Modular Reactors
- Next Generation Nuclear Plant Demonstration Project
- Light Water Reactor Sustainability
- Advanced Reactor Concepts

These reactor technologies will support a diverse set of fission power systems capable of producing electricity (MWe) and, in the case of NGNP, generating process heat (BTUs) in a socially acceptable, environmentally sustainable, and economically attractive manner. Development of each reactor concept will seek to improve performance, economics, safety, waste minimization, and reduced proliferation risks. Some reactor technologies in the long term may support sustainable fuel cycle options without increasing nuclear proliferation and security risks.

SMRs have potential advantages over larger plants by providing an owner more flexibility in financing, siting, sizing, and end-use applications. SMRs can reduce an owner's initial capital outlay or investment due to the lower plant capital cost. Modular components and factory fabrication can reduce construction costs and schedule duration. Additional modules can be added incrementally as demand for power increases. SMRs can provide power for applications where large plants are not needed or may not have the necessary infrastructure to support a large unit such as smaller electrical markets, isolated areas, smaller grids, or restricted water or acreage sites.

SMRs also are expected to provide potential nonproliferation benefits to the United States and the wider international community. Some SMRs could be able to operate for decades without refueling. These

SMRs would be fabricated and fueled in a factory, sealed and shipped to the site, and then returned to the factory for defueling at the end of its life cycle. This approach could help to minimize the spread of nuclear material. There is both a domestic and international market for SMRs and U.S. industry is well positioned to compete for these markets.

The NGNP program supports the design, licensing, and R&D necessary to demonstrate a gas-cooled reactor technology in the United States. The NGNP would be a small-to-medium sized reactor capable of high-temperature operation in excess of 700°C. Plants of this type should have a good combination of size, heat-output and passive safety features to make them favorable candidates for use in industrial settings. The NGNP program is a collaborative enterprise with participation by the Department's national laboratories, U.S. universities, the nuclear industry, and the NRC, and includes work on a regulatory framework for licensing an NGNP, plant design, and R&D. Near-term emphasis is on developing information that will support key decisions by the Secretary of Energy on the future of the program. Important considerations include the availability of a licensable fuel for the reactor, qualification of nuclear grade graphite, design of high project-risk components such as steam-generators and gas-coolant circulators, and the development of form and content requirements needed to submit a license application for an advanced gas-cooled reactor.

The LWRS program conducts research to ensure a technical basis for the long-term, safety and reliability of currently operating LWR nuclear power plants from the currently expected 60 years to perhaps 80 years or longer. The LWRS program focuses on developing the scientific basis to understand, predict, and measure changes in materials, systems, structures, and components as they age in environments associated with continued long-term operations of existing LWR reactors. The program will then apply this knowledge to develop and demonstrate methods and technologies that support safe and economical long-term operation of existing reactors. In addition, the program will research new technologies to address enhanced plant performance, economics, and safety in the existing LWR fleet.

Advanced Reactor Concepts (formerly Generation IV Nuclear Energy Systems Research and Development (GEN IV)) provide technical, economical, and environmental benefits for clean and sustainable energy produced by the nuclear energy option. NE will pursue these technical advancements through R&D activities with national laboratories, universities, industry and other domestic and international governmental partners. These activities include conducting traditional R&D needed to advance the technologies; pioneering the use of advanced modeling and simulation; supporting international collaborative work to use available facilities for nuclear R&D; and reducing the technical uncertainties for deploying new nuclear reactor technologies. The program will carry on Gen IV R&D and will research innovative nuclear energy technologies that can compete economically with other technologies for the production of electricity, provide clean (low-carbon) energy resources, and minimize environmental impacts. Activities carried out under Advanced Reactor Concepts will focus on the development of advanced materials for structures, components and fuel claddings for use with various coolants that face high-radiation, high-temperature environments.

This program will also utilize advanced modeling and simulation activities to directly support reactor related activities in order to extrapolate and predict behaviors beyond tested states as well as improve experiments by predicting areas of interest and validating expected experimental results. The program will create and deploy science-based, verified, and validated modeling and simulation capabilities essential for the design, implementation, and operation of all aspects of nuclear energy systems and their nuclear fuel cycles to improve U.S. energy security. Program activities encompass the micro behavior level of fuels and materials in Fuel Cycle R&D, to the macro behavior level of reactor systems (e.g., LWRs and advanced reactors in Reactor Concepts RD&D) and their fuel cycles. The successful application of these advancements will enable the use of computer simulation in a fundamentally new way for design, licensing, and operation of nuclear systems.

The modeling and simulation activities in this program will differ from those conducted in the Energy Innovation Hub for Modeling and Simulation (Hub) within the NEET program. While modeling and simulation activities carried out in the Reactor Concepts RD&D and Fuel Cycle R&D programs are focused on building new advanced modeling and simulation capabilities in the areas of nuclear fuels, separations processes, material safeguards, waste forms, and repositories for near-term, mid-term, and long-term nuclear power system concepts, the Hub will have a narrower focus of validating and demonstrating the application of modeling and simulation capabilities through the virtual modeling of an existing operating reactor. Additionally, the Hub will be managed by an independent consortium. While the Hub activities may complement those in the NE program, they are not directly linked to the activities proposed under Fuel Cycle R&D and Reactor Concepts RD&D.

NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to supporting R&D activities at university and educational research institutions, NE programs competitively award funds that support both mission-specific and mission-related activities. NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities to conduct R&D.

Reactor Concepts RD&D activities provide technical benefits across the NE R&D portfolio. These technical advancements and anticipated benefits include pioneering the use of advanced modeling and simulation, creating an international network of user facilities for nuclear R&D, and reducing the technical uncertainties surrounding new nuclear reactor technologies. These advancements will allow nuclear energy to compete economically with other clean energy technologies.

The energy sector must supply increasing amounts of electricity safely, dependably, economically, and in an environmentally advantageous manner with reduced CO_2 emissions. The 60-year licenses for the current nuclear power plants will begin to expire in 2029. Utilities are beginning to initiate planning for baseload replacement power and the technology options developed under the Reactor Concepts RD&D program can help ensure that nuclear energy remains a key part of the U.S. energy portfolio. These concepts may also help enable the United States to regain technical leadership and economic competitiveness in the global marketplace.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Small Modular Reactors	**0**	**0**	**38,880**

This program element supports laboratory/university and industry cost-shared projects to conduct nuclear technology R&D and to develop advanced computer modeling and simulation tools that demonstrate and validate new design capabilities of innovative SMR designs. These activities focus on demonstrating that SMRs provide an innovative reactor technology that is capable of achieving electricity generation and performance objectives that meet market demands and are comparable, in both safety and economics, to the current large base load nuclear power plants. The Department plans to, through a competitive process,

	(dollars in thousands)	
FY 2009	FY 2010	FY 2011

solicit and select up to two SMR designs for financial cost-share assistance. These funds are required to help demonstrate the potential of the nascent SMR technology and encourage new competition in the marketplace. In the near term the Department would fund the LWR SMR program on a cost-shared basis with a view toward design certification; support the development of new/revised nuclear industry codes and standards necessary to support licensing and commercialization of innovative designs; and, consistent with NRC guidance and regulations, identify activities for DOE funding to enable SMR licensing for deployment in the United States.

Assessments and Evaluation - In FY 2010, DOE will hold workshops with LWR SMR vendors and suppliers, potential utility customers, national laboratory, and university researchers, DOE, NRC, and other stakeholders, to identify potential priorities to enable their commercialization and development. The Administration will evaluate potential priorities in the context of the appropriate Federal role to identify the most cost effective, efficient, and appropriate mechanisms to support further development. DOE will then develop a detailed five-year roadmap for the Administration's SMR efforts. Possible areas of activity in FY 2011 could include cost-shared activities and R&D on sensors, instrumentation and controls, material qualification for novel components, component and system validation testing, and the extension of modeling and simulation codes to SMR configurations and validation. This funding also supports work to be conducted in conjunction with the Standards Developing Organizations (ANS, ASME, IEEE, ASTM, etc) to revise and establish nuclear codes and standards that need to be developed by on a priority bases to support SMR designs.

Advanced Small Modular Reactor R&D - NE will support R&D activities for advanced non-LWR small modular reactor designs, including high-temperature designs and ones and that utilize fast spectrum neutrons and associated fuel and reactor technologies, which offer added functionality and affordability. For these SMRs based on concepts with lower levels of technical maturity, the Department will first seek to establish the laboratory/university R&D activities necessary to prove and advance innovative reactor technologies and concepts towards commercialization. The Department will support R&D activities at its national laboratories and universities to develop and prove the proposed design concepts. Emphasis will be on advanced reactor technologies that offer simplified operation and maintenance for distributed power and load-following applications and increased proliferation resistance and security. Areas of R&D could include: basic physics and materials research and testing; state-of-the-art computer modeling and simulation of reactor systems and components; probabilistic risk analyses of innovative safety designs and features; and other development activities that are necessary to establish tbe feasibility of the concept for future deployment. In addition, some funds may be used to begin implementing certain activities outlined in the forthcoming roadmap described above.

Next Generation Nuclear Plant Demonstration Project	**0**	**0**	**103,032**

This program sponsors a collaborative effort with universities, industry, and the NRC to conduct the design, licensing and R&D necessary to demonstrate a gas-cooled reactor technology in the United States.

In FY 2010, the Department will engage with industry to complete cost-shared conceptual designs for the NGNP. In the first quarter of FY 2011, the NEAC will review the conceptual design reports along with the state of NGNP R&D and licensing activities and make recommendations on whether or not to proceed into Phase 2 of the project. Phase 2 includes the selection of one technology for final design, licensing, R&D, and construction. If the Secretary of Energy determines that the NGNP should start Phase 2, then the Department will seek cost-sharing partners to conduct the Phase 2 scope of work.

The Department continues to work with the U.S. private sector to establish industrial end-user requirements, produce trade studies integrating NGNP into various industrial applications, and develop cost-sharing strategies to support industry in their efforts to commercialize gas-cooled reactor technologies. Because the project is now in the demonstration phase, the private sector cost share in FY 2011 is expected to be at least 50 percent, consistent with Energy Policy Act of 2005. Similarly, the Department's collaboration with the NRC is speeding the development of a framework for licensing gas-cooled reactors in the United States. Key issues include the establishment of gas-cooled reactor-specific requirements for emergency planning zones, containment design, and the quantification of potential radioactive releases. Finally, the Department is working with universities, national laboratories, and the international community to develop analytical tools, identify additional R&D needs, and conduct tests on fuel, metals and graphite to support the data needs of the reactor designers, regulators, and end-users. The Idaho National Laboratory (INL) coordinates NGNP R&D on behalf of the Department.

FY 2009 and FY 2010 activities are discussed under the Gen IV budget.

In FY 2011, the Department will:

- Sponsor an independent review of NGNP activities by the NEAC.
- Make a decision on readiness to proceed into Phase 2 of the NGNP project.
- Enter into a cost-sharing public-private partnership to conduct design and licensing activities leading to NRC issuance of a Combined Operating License.
- Continue the irradiation in the INL Advanced Test Reactor (ATR) of the first NGNP fuel produced in commercial scale production equipment (AGR-2).
- Complete post-irradiation examination of the first NGNP fuel tested in the ATR.
- Continue selection and characterization of NGNP graphite and composite materials, including the irradiation of the first AGC-1 test experiment to provide data for nuclear graphite qualification.
- Initiate assembly of High-Temperature Vessel experiments 1 and 2 for irradiation at Oak Ridge that is necessary to obtain critical data (physical expansion, process monitoring) for designing AGC-5 and AGC-6.
- Continue environmental, mechanical property, and joining method (e.g., welding) studies for selected heat exchanger and reactor pressure vessel materials for code-case data package development and qualification.
- Complete Regulatory Gap Analysis that will review existing NRC rules and regulations and identify their applicability to gas reactors.
- Continue topical report analysis and responses to possible Requests for Additional Information from the NRC, to support the NRC's development of form and content requirements needed to submit a license application for an advanced gas-cooled reactor.
- Continue international R&D collaborations through the GIF VHTR System Arrangement and associated second tier Project Arrangements.
- Develop capability to subject structural materials to a combination of tension and torsion to simulate the stress state in the NGNP and to understand and model component material response under complex stress states.
- Use existing test facilities (High-Temperature Test Reactor in Japan) and construct separate effects and integral effects test equipment to perform thermal-fluid behavior validation experiments.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

- Conduct research on process heat applications, including system interface requirements and materials compatibility issues, for coupling NGNP to various non-electric applications.
- Continue fuel performance modeling, fabrication modeling, and fission product transport modeling.
- Conduct methods development and experimental validation to determine the capability of the passive system to remove decay heat and to validate state-of-the-art thermal-fluid models for the unique geometry of the NGNP reactor cavity cooling system.

Light Water Reactor Sustainability	**0**	**0**	**25,758**

This program will conduct R&D to extend the operating lifetime of current plants beyond 60 years and, where possible, enable further improvement in their productivity. The program will partner with industry and the NRC to conduct the long-term research needed to inform major component refurbishment and replacement strategies, performance enhancements, plant license extensions, and NRC's age-related regulatory oversight decisions. The research will focus on aging phenomena and issues that require long-term research that affect the existing fleet of both boiling and pressurized water reactors. Because industry has a significant financial incentive to extend the life of existing plants, the Department will work to ensure that activities are cost-shared to the maximum degree possible.

Planned activities are divided into five areas:

(1) Materials Aging and Degradation Assessment will develop a science-based fundamental understanding of materials aging and degradation to reduce the uncertainty in analytical predictions and provide insights for developing components with longer lifetimes. A mechanistic understanding of key materials aging and degradation phenomena will support longer-term operation of existing reactors, support licensing basis for extended operations, and support component life predictions for critical structures, systems, and components.

(2) Safety Margin Characterization will develop improved modeling and analysis methods including uncertainty quantification to enhance industry's ability to accurately predict safety margins, address aging effects to understand how safety margins change with aging plants, support power up-rates, and combine risk-informed, performance-based methodologies with fundamental scientific understanding of critical phenomenological conditions and deterministic predictions of nuclear plant performance.

(3) Efficiency Improvements will address the potential for additional power up-rates and capacity factor improvements as well as the possibility of reduced operations of operating reactors due to the unavailability of adequate supplies of secondary cooling water. Drought conditions and competition with other users have created situations that are of immediate concern.

(4) Instrumentation and Controls will develop new systems and human/machine interface capabilities including advanced plant monitoring capabilities, support power up-rates and plant efficiency improvements, support longer-term operation, facilitate centralized monitoring of nuclear status and performance, and develop advanced condition monitoring and prognostics technologies to understand and measure the aging of systems, structures, and components of nuclear power plants.

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

(5) Advanced LWR Fuel will develop new long-life fuel designs using advanced materials for fuel and cladding to achieve substantial increases in safety margins and performance, eliminate fuel failures, and achieve higher fuel burn-ups. Goals include improving the fundamental understanding of nuclear fuel and cladding behavior under extended burn-up conditions, developing a predictive analysis tool for advanced nuclear fuel performance, and developing advanced mesoscale fuel models to enable a predictive analysis of fission gas release.

FY 2010 activities are discussed under the Gen IV budget.

In FY 2011, the Department will:

- Address high-fluence neutron irradiation effects on reactor metals including the reactor pressure vessels and core internals (stainless steels and high strength alloys), radiation-induced swelling effects, and phase transformation of core internals.
- Evaluate long-term aging of concrete structures.
- Investigate crack initiation in nickel-based alloys (steam generator tubing).
- Examine advanced mitigation techniques such as welding and weld repair techniques, post-irradiation annealing and modern replacement alloys.
- Develop a risk-informed simulation-driven methodology to guide safety system analysis and uncertainty quantification.
- Enhance the deterministic safety analysis capability to simulate plant dynamics and compute safety margin.
- Incorporate passive structures, systems, and components into a probabilistic safety analysis at one plant type.
- Develop alternative and new cooling technologies that can be applied in the near term to reactors impacted by insufficient cooling water supplies.
- Develop innovative technologies that lessen the environmental impacts of removing large volumes of cooling water from naturally occurring sources.
- Develop plant control and monitoring systems to improve plant efficiency, facilitate power up-rates, and enable remote monitoring and support.
- Develop a model for fuel cracking at the mesoscale level with sufficient understanding to develop a predictive model for fission gas release.
- Begin the development of new long-life fuel designs with advanced fuel and cladding materials.

	FY 2009	FY 2010	FY 2011
Advanced Reactor Concepts	**0**	**0**	**21,870**

This program is an expanded version of the Gen IV R&D program. It will continue the Gen IV R&D work being done today but has been expanded to encompass reactor technologies beyond Generation IV. The program will focus on reactors that could dramatically improve performance in sustainability, safety, economics, security, and proliferation resistance. This work includes scientific research at national laboratories and universities as well as through international collaboration. Competitive cost-sharing arrangements will be used where practical to establish beneficial government-industry partnerships.

Both advanced thermal and fast reactor systems will be considered. Fast reactors could be employed to consume long-lived, high-activity elements found in used LWR fuels as part of a long term waste management approach if economic, technical, safety, and proliferation challenges are addressed. Some modified open fuel cycle concepts are enabled by fast neutron spectra. Fast reactors using a variety of coolants will be considered. Some research activities are coordinated with foreign researchers through the GIF as well as other bilateral and multilateral agreements. R&D to support a domestic Sodium Fast Reactor (SFR) prototype reactor has been discontinued. Long term R&D on Gen IV reactor concepts, including the SFR, with international GIF partners will continue. This element includes an examination of supercritical carbon dioxide as a working fluid for a more efficient method of producing electricity. Support is also included for the international policy and experts groups of the GIF, including working groups for common evaluation methodologies of reactor economics, safety, and proliferation resistance and physical protection. Reactor component testing and infrastructure needs will be evaluated and prioritized to support R&D activities according to technical and policy requirements. General technical support associated with international R&D collaborations that is not technology-specific is provided by the International Nuclear Energy Cooperation program.

In order to be effective, innovative reactor design concepts must consider the overall system performance, e.g., fuel and reactor performance and economics, material utilization and waste disposition, and non-proliferation considerations. Integrated reactor concepts will employ a diverse range of innovative ideas. It is important to both confirm the feasibility and assess the importance of technology innovations. R&D on innovative concepts will be guided by a clear assessment of potential performance and economic improvements. The existing knowledge base and the pursuit of new ideas will generate innovative concepts to focus R&D, with the goal of developing transformational technologies.

In FY 2011, the Department will:

- Evaluate innovative reactor systems to identify promising candidates for further R&D as part of an integrated system.
- Evaluate heat transfer properties for a wide range of operating fluids and conditions; testing will be conducted for innovative heat exchange systems.
- Complete post-irradiation examinations on unique material samples obtained from the Fast Flux Test Facility and the Phénix Fast Reactor in France to obtain mechanical and physical properties of these materials for use in materials model development.
- Continue advanced modeling techniques utilizing the Department's high-speed, parallel computers for the development of close-coupled neutronic and thermofluid codes.
- Demonstrate the technical and economic viability of an advanced Brayton-cycle energy-conversion system using supercritical carbon dioxide as the working fluid.
- Conduct nuclear data measurements and validation, specifically cross section and other nuclear data measurements needed for advanced fast reactor designs and safety validation.
- Conduct research on components or systems applicable to multiple reactor concepts, such as fuel handling, in-service inspection and repair, and energy conversion.
- Continue international collaboration on nuclear safety and cost reduction.
- Evaluate molten salt and other advanced reactor conceptual ideas.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
SBIR/STTR	**0**	**0**	**5,460**

The FY 2011 amount shown is an estimated requirement for the continuation of the SBIR and STTR program.

Total, Reactor Concepts Research, Development and Demonstration	**0**	**0**	**195,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Small Modular Reactors The increase from $0 to $38,880,000 reflects the addition of a new SMR budget element beginning in FY 2011.	+38,880
Next Generation Nuclear Plant Demonstration Project The increase from $0 to $103,032,000 reflects the shift of NGNP from the Gen IV budget to this new budget. In FY 2010, NGNP is funded at $164,373,000. The FY 2011 request reflects the appropriate level of activity for the project in FY 2011 and adequately funds all project needs.	+103,032
Light Water Reactor Sustainability The increase from $0 to $25,758,000 reflects the new budget structure for reactor-related R&D, not the true increase in funding for LWRS activities within NE. In FY 2010, LWRS activities were funded at $9,720,000 as part of the Gen IV program. Therefore, the actual increase in funding for these activities in FY 2011 is $16,038,000. This increase will focus on expanding the experimental suite across all research pathways, whereas in FY 2010 research was limited to materials and advanced fuels.	+25,758
Advanced Reactor Concepts The increase from $0 to $21,870,000 reflects the transfer of reactor technology activities previously included in Gen IV R&D and the inclusion of new R&D on reactor technologies beyond Gen IV. In FY 2010, Gen IV R&D activities not associated with LWRS were funded at $18,601,164.	+21,870
SBIR/STTR The increase from $0 to $5,460,000 reflects the contribution of R&D funding for SBIR/STTR.	+5,460
Total Funding Change, Reactor Concepts Research, Development and Demonstration	**+195,000**

of its research and development (R&D) and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts Research, Development & Demonstration and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

Nuclear Hydrogen Initiative
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Nuclear Hydrogen Initiative	7,343	0	0	0

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)

Mission

This program was completed at the end of FY 2009. Consistent with the FY 2010 request, the FY 2011 budget requests no funding for the Nuclear Hydrogen Initiative (NHI).

Benefits

In FY 2009, the program completed experiments and testing on long-term cell operability, thermal cycling, process stability, and other important questions, developing insights into high-temperature thermochemical cycles, high-temperature electrolysis, and reactor/process interface issues.

Annual Performance Results and Targets

In FY 2009, the program completed research activities including high temperature electrolysis experiments and testing on the Sulfur-Iodine integrated laboratory-scale thermochemical experiment to assess process stability and component durability.

Means and Strategies

The Department has implemented the following means:
- Researched hydrogen production technologies compatible with nuclear energy systems with the participation of the national laboratories, industry, and university research communities as well as international research partners.

The Department has implemented the following strategies:
- Partnered with the private sector, national laboratories, universities, and international partners.

Validation and Verification

The Office of Nuclear Energy (NE) conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight

Nuclear Hydrogen Initiative
Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Nuclear Hydrogen Initiative	7,343	0	0

Benefits

By completing experiments and testing on long-term cell operability, thermal cycling, process stability, and other important questions, the program developed useful insights into high temperature thermochemical cycles, high temperature electrolysis, and reactor/process interface issues.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Nuclear Hydrogen Initiative	**7,343**	**0**	**0**

Through FY 2009, this program focused on long-term R&D activities associated with thermochemical and High Temperature Electrolysis (HTE) processes designed to demonstrate the viability of using heat and/or electricity from various advanced reactors researched by the Generation IV Nuclear Energy Systems program (mainly Next Generation Nuclear Plant). In FY 2009, integrated laboratory-scale experiments were completed and long-term performance of components and materials evaluated.

NHI R&D activities have been conducted through several vehicles including international collaborations via the Generation IV International Forum and bilateral agreements pioneered under the International Nuclear Energy Research Initiative and domestically via the national laboratories.

In FY 2009, the Department:
- Completed HTE experiments begun in FY 2008 to investigate long-term cell operability and thermal cycling issues.
- Completed operation and testing on the Sulfur-Iodine integrated laboratory-scale thermochemical experiment to assess process stability and component durability.
- Finalized investigation of improved membranes for the Hybrid Sulfur electrolyzer.
- Summarized research findings and identified HTE as the hydrogen production technology with the most promise for future development and deployment with advanced nuclear reactors.
- Completed the final year of university research projects awarded in FY 2007.

	FY 2009	FY 2010	FY 2011
Total, Nuclear Hydrogen Initiative	**7,343**	**0**	**0**

Fuel Cycle Research and Development

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Fuel Cycle Research and Development	142,652	0	136,000	201,000

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)
P.L. 111-85, Appropriation Act (2010)

Mission

The mission of Fuel Cycle Research and Development (R&D) program is to research and develop nuclear fuel and waste management technologies that will enable a safe, secure, and economic fuel cycle. Beginning in FY 2010, the program shifted from a near-term technology development and deployment program to a long-term, science-based R&D program which has the potential to produce beneficial changes to the way the fuel cycle, and particularly spent fuel, is managed. The program will examine three fuel cycle approaches: once-through fuel cycle, modified open fuel cycle, and full fuel recycle. Examination of this full range of approaches is critical to provide future decision-makers with information needed to make decisions on how best to manage used fuel. In addition, the Office of Nuclear Energy (NE) will leverage transformative and crosscutting R&D activities carried out by the Nuclear Energy Enabling Technologies program, complementing the R&D carried out in this program. NE will oversee on-going responsibilities under the Nuclear Waste Policy Act. Within the Fuel Cycle R&D program, these include activities associated with nuclear waste management.

Benefits

The Fuel Cycle R&D program supports long-term technology development activities and will:

- Develop high burn-up and other fuels for use in reactors that could help reduce the amount of used fuel for direct disposal for each megawatt-hour of electricity produced;
- Investigate fuel forms, reactors and fuel/waste management approaches that could dramatically increase utilization, if economically competitive, of fuel resources and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed (per megawatt-hour). Technologies will be considered that require at most limited separation steps and minimize proliferation risks; and
- Develop techniques that will enable long-lived actinide elements to be repeatedly recycled. The ultimate goal is to develop a cost-effective and low-proliferation-risk approach that would significantly decrease the long-term challenges posed by the waste and reduce uncertainties associated with its disposal.

The goal is to perform R&D within each of the three tracks above to advance fuel cycle technologies and waste management strategies to inform decision-making.

Annual Performance Results and Targets

The Fuel Cycle R&D program's performance measure aligns to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the GPRA Unit Program Goal of New Nuclear Generation Technologies. The Fuel Cycle R&D performance measure aligns to these goals by tracking progress on researching and developing nuclear fuel and waste management technologies that will enable a safe, secure, and economic fuel cycle. This will involve identifying gaps in knowledge and uncertainties that require resolution and making progress toward key technology challenges and goals. The program will help create a safe and sustainable path forward and help to optimize the nuclear fuel cycle. Developing these advanced technologies decreases the fuel cycle risks associated with nuclear power plants, increasing the likelihood that new nuclear power plants will be deployed, thus contributing to greenhouse gas abatement efforts.

Fuel Cycle R&D Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: New Nuclear Generation Technologies

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**

FY 2011 Efficiency Performance Measure: *Maintain total administrative overhead costs in relation to total R&D program costs of less than 8 percent.*

T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:

Fuel Cycle R&D FY 2011 Effectiveness Performance Measure: Demonstrate progress toward the long-term mission to develop options to the current commercial fuel cycle management strategy by establishing long-term strategic plans for the program, identifying gaps in knowledge and uncertainties to resolve, and beginning the path to achieve the program's grand challenge goals.

FY 2010: Demonstrate progress toward the long-term mission to develop options to the current commercial fuel cycle management strategy by establishing long-term strategic plans for the program, identifying gaps in knowledge and uncertainties to resolve, and beginning the path to achieve the program's grand challenge goals.

FY 2009: Support the development of advanced technologies to close the fuel cycle by performing specific used fuel separations, transmutation fuels and fast reactor research and development activities in support of the AFCI.

FY 2008: Create a technology development document on recycling technology options, including their readiness and risks, the state of technology development achieved to date, future research and development, and economic evaluations needed to achieve the Global Nuclear Energy Partnership vision.

FY 2007: Complete research and development activities, focused on advanced fuel separations technology development and demonstration, to support the Secretary of Energy's determination of the need for a second geologic repository for spent nuclear fuel by FY 2008.

FY 2006: Complete research and development activities that allow the Advanced Fuel Cycle Initiative (AFCI) program to support the Secretary of Energy's determination of the need for a second geologic repository for spent nuclear fuel by FY 2008.

T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A: 1 (Met)	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:

Means and Strategies

The Fuel Cycle R&D program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:
- Conduct long-term science-based R&D through small-scale experiments, theory development, modeling and simulation, validation experiments, and development of transformational technologies that have the potential to produce beneficial changes in the way the nuclear fuel cycle, and particularly nuclear waste, is managed.
- Conduct R&D needed for the Department to provide input into the Administration's development of a National nuclear waste management strategy and to support the planned Blue Ribbon Commission.
- Leverage transformative and crosscutting R&D activities carried out by the Nuclear Energy Enabling Technologies program, complementing the R&D carried out in this program.

The Department will implement the following strategies:
- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop advanced nuclear technologies.
- Programs will also engage the international community in pursuit of advanced nuclear technology that will benefit the United States in terms of enhanced safety, improved economics, and reduced production of wastes.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:
- Nuclear energy research programs rely on data produced through collaborations with foreign nations. Should vital data from foreign partners prove unavailable, U.S. efforts would need to be re-evaluated.

In carrying out the program's mission, the program performs the following collaborative activities:
- The Fuel Cycle R&D program is undertaking long-term R&D on fuel cycle technologies to provide the U.S. government with information on and options for the long-term disposition of spent nuclear fuel. Interdependencies with the Office of Environmental Management include collaboration on spent fuel treatment technologies and waste forms to avoid duplication of effort.
- Interdependencies with National Nuclear Security Administration (NNSA) include coordination of advanced material control and accountability monitoring technology development, and safeguards and security aspects of advanced fuel cycle technologies.
- Interdependencies with the Office of Science (SC) include providing the basic science tools that can be used to close technology gaps that currently impede the implementation of fuel cycle technologies. Interfaces in basic energy sciences including actinide chemistry and materials, nuclear physics, and development of advanced simulation and modeling tools must be coordinated between NE and SC.
- The Department and the NRC coordinate program planning to assure that their R&D activities are complementary, cost effective, and not duplicative.
- Participation in international experiments related to the development of advanced fuel cycle technologies is being performed in support of Fuel Cycle R&D program objectives.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts Research, Development and Demonstration (RD&D) and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE engages its stakeholders to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences.

Fuel Cycle Research and Development

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Fuel Cycle Research and Development			
Separations and Waste Forms	40,355	41,615	31,324
Advanced Fuels	28,975	29,651	40,000
Transmutation Research and Development	28,394	4,288	0
Modeling and Simulation	24,845	26,009	15,570
Systems Analysis and Integration	20,083	14,783	15,664
Materials Protection, Accountancy, and Controls for Transmutation	0	6,826	7,814
Used Nuclear Fuel Disposition	0	9,124	45,000
Modified Open Cycle	0	0	40,000
SBIR/STTR	0	3,704	5,628
Total, Fuel Cycle Research and Development	142,652	136,000	201,000

Benefits

The program focus has been re-directed from near-term technology deployment to long-term, results-oriented, science-based R&D which has the potential to produce beneficial changes to the way the fuel cycle, particularly used nuclear fuel, is managed. The program will research and develop technologies for each of three fuel cycle management approaches (once-though fuel cycle, modified open fuel cycle, and full fuel recycle).

The Fuel Cycle R&D program is an integrated program to research, develop, and improve fuel cycle and waste management options and technologies. It involves small-scale experiments coupled with theory development and advanced modeling and simulation with validation experiments. This science-based R&D program will provide a more complete understanding of the underlying science supporting the development of advanced fuel cycle and waste management technologies and, therefore, help provide a sound basis for future decision-making. The program will also conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles.

NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to support R&D activities at university and educational research institutions, NE programs competitively award funds that support both mission-specific and mission-related activities. NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects. The national laboratories are encouraged to partner with universities to conduct R&D.

The Fuel Cycle R&D program also collaborates with nuclear industry and, where appropriate, international partners from other countries with advanced fuel cycles to leverage U.S. research investments and pursue common goals towards advanced fuel cycles that are economic, minimize waste, and reduce proliferation risk. The program provides technical support to NE's international mission via participation in meetings, seminars, related publications, and international technical cooperation agreements. Fuel Cycle R&D continues to pursue and seek new international cooperation activities that leverage the program's activities for mutual benefit and provide access to facilities not available in the United States, such as fast spectrum test reactors for advanced fuel testing.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Separations and Waste Forms	**40,355**	**41,615**	**31,324**

The mission of the Separations and Waste Forms technical area is to develop the next generation of used fuel separations and waste management technologies that enable a sustainable fuel cycle with minimal processing, waste generation, and potential for material diversion. Challenges in separations and waste forms include: 1) develop separations technologies and systems with reduced proliferation risk, very low process losses, and minimal undesirable waste streams; and 2) develop waste forms with predictable, long-term behavior and enhanced resistance to long-term degradation suitable for a variety of potential storage or geologic repository environments.

In FY 2009, the Department:

- Continued to research advanced aqueous separations processes with an increasing emphasis on simplification of the process steps including investigating alternate extraction processes to minimize the number of different solvents needed.
- Continued research on electrochemical processing technologies with a focus on improving process throughput and process control and monitoring technologies.
- Investigated safeguards issues related to special material accountability.
- Continued R&D to optimize the stability of waste forms and the efficiency of waste form production through laboratory-scale demonstration of solidification processes for both glass and metal waste forms.
- Characterized waste forms resulting from separations processes and investigated their potential performance in a variety of geological settings.
- Evaluated metal waste forms to understand and define waste loading performance.
- Prepared the first metal waste form using surrogate undissolved solids.

In FY 2010, the Department is:

- Researching innovative methods for the separation of americium or americium/curium in a single process step.
- Researching innovative methods to capture off-gasses such as iodine and krypton from the head end processes and immobilize the captured gasses.
- Developing advanced concepts for electrochemical processing to recycle salt for waste minimization, advanced methods for transuranic recovery, and novel product consolidation methods.
- Developing alternative waste forms that are tailored to specific radionuclides and potential geologic media.
- Characterizing waste forms and assessing their performance in a variety of potential geologic

media.

- Investigating new waste forms for electrochemical process inactive metals and spent salt streams.
- Evaluating current methodologies for assessing proliferation risk and developing a plan for integrating new and existing concepts into analytical tools for evaluating proliferation risks associated with fuel cycle concepts. Probabilistic risk assessment approaches will be included in the evaluation.
- Developing advanced fuel cycle instrumentation that will provide for online/at-line, near real-time, active and passive nondestructive monitoring of electrochemical and aqueous processes.
- Developing advanced safeguards approaches, including formalization of requirements, for advanced fuel cycles.
- Developing modeling and simulation approaches to support radiation transport and detection, materials behavior in harsh environments, development of radiation and non-radiation based signatures, performance assessments/optimization, virtual inspector presence, and data visualization.

In FY 2011, the Department will:

- Continue to research innovative methods for the separation of americium or americium/curium in a single process step.
- Continue to research innovative methods to capture off-gasses such as iodine and krypton from the head end processes and immobilize the captured gasses.
- Continue to develop advanced concepts for electrochemical processing to recycle salt for waste minimization, advanced methods for transuranic recovery, and novel product consolidation methods.
- Continue to develop alternative waste forms that are tailored to specific radionuclides and potential geologic media.
- Continue to characterize waste forms and assess their long-term stability.
- Continue to investigate new waste forms for electrochemical process inactive metals and spent salt streams.

	FY 2009	FY 2010	FY 2011
Advanced Fuels	**28,975**	**29,651**	**40,000**

The mission of the Advanced Fuels technical area is to perform R&D on fuel systems and fabrication processes to achieve multi-fold improvements in fuel and fabrication process performance. This will be in direct support to NE's imperatives of extending plant lifetimes, enabling new reactor builds, and developing sustainable fuel cycles through advanced transmutation fuels. One challenge in advanced fuels is to develop nuclear fuels and/or targets for thermal and fast reactors with multi-fold increases in performance over previous generation fuels. Fuel research under Fuel Cycle R&D is specifically motivated by fuel cycle challenges.

Within the context of long-term (40+ years) waste management technology R&D investigated by the Fuel Cycle R&D program, the design and development of advanced fuels that could ultimately be utilized in fast reactors would be pursued. These activities would include investigating conceptual design modifications to fast reactor concepts to accommodate advanced fuels developed by the program. The Advanced Fuels technical area will also initiate R&D on fuel resources that may improve the sustainability of nuclear energy in the long term and enhance the security of the fuel supply.

In FY 2009, the Department:

- Initiated post-irradiation examination of Advanced Test Reactor (ATR) test fuel pins removed from the test reactor in FY 2008.
- Continued irradiation and testing of metal and oxide transmutation fuels in the ATR.
- Researched fuel fabrication processes evaluating advanced cladding materials.
- Completed irradiation of U.S. origin transmutation fuels in the French Phénix fast reactor. This reactor was permanently shutdown in FY 2009.
- Continued to prepare transmutation-related feedstock material needed for national and international fuels irradiation testing.
- Continued international collaborations on innovative fuel development.
- Continued development of instrumentation and controls for safeguarding nuclear materials during the fuel cycle and waste management process.
- Initiated development of safeguards related tools and methods for advanced integration and control to enable knowledge extraction of facility operation.
- Investigated safeguard issues related to special material accountability in metal fuel fabrication systems.

In FY 2010, the Department is:

- Exploring innovative fuel designs including transmutation fuels with long-term high performance payback such as composite dispersion fuels with microstructural properties targeted for specific characteristics.
- Continuing to develop advanced fabrication techniques that provide the desired control on fuel microstructure with the inclusion of strategic additives if needed.
- Performing analyses to investigate potential transformational advances in advanced fuels development.
- Initiating small-scale experiments needed to verify specific features of modeling development needs.
- Continuing post-irradiation examination of irradiated experiments from the Fast Flux Test Facility and ATR, as required for input to fuel performance modeling and initiating plans for the return of the U.S. material irradiated in Phénix.
- Developing initial plans for the development of advanced Light Water Reactor (LWR) fuels and claddings in coordination with the LWR Sustainability activity within the Reactor Concepts RD&D program, industry, and universities.
- Continuing irradiation experiments at ATR for the development of advanced oxide and metal fuels and initiated plans for future separative effects testing to support advanced model development.

In FY 2011, the Department will:

Modeling & Simulation (M&S) Support

- Provide advanced fuels requirements input to the M&S program and seek clarification on what M&S parameters need experimental verification in the fuels program.
- Support development and fabrication of experimental techniques that are closely coupled to

M&S development needs, including advanced instrumented irradiation assembly designs for use in ATR and High Flux Isotope Reactor.

- Initiate design and fabrication of an instrumented test assembly for use in ATR to permit parameter uncertainty reductions needed in M&S code development.
- Continue to support performance-modeling development via small-scale experiments to investigate important separate effects.

Post-Irradiation Examination (PIE)

- Initiate destructive PIE on fuel pins from the shutdown Fast Flux Test Facility. These mixed oxide pins, and their associated HT-9 clad material, are the highest burn up fast spectrum reactor fuel in the world, and are of significant national and international interest.
- Transfer irradiated U.S.-origin fuels and materials from Phénix and initiate PIE.
- Continue supporting plans for developing needs and requirements for the Idaho Transient Reactor Test Facility which will be needed for licensing related testing of any new fuel to be used in a nuclear power reactor in the United States. There is significant international interest (France, Japan) in this facility due to its unique testing capabilities.
- Continue to expand the use of new, highly advanced, post-irradiation devices as they become available. Additional post-irradiation characterization equipment will be radiation hardened (e.g. focused Ion Beam) so they can be used on irradiated samples.

Fabrication

- Continue fabrication and characterization development of metal fuels, with the capability to transmute large quantities of minor actinide bearing fuel so its technology readiness level is made comparable to oxide-based mixed oxide fuel. Fabrication process heat modeling will be continued in support of this activity and also to support ceramic development as needed.
- Continue fabrication, characterization, testing, and modeling of ceramic fuels having the capability to transmute large quantities of minor actinides and fission products.
- Continue to develop advanced fabrication techniques that provide the desired control on fuel microstructure with the inclusion of strategic additives if needed.

Other Fuel Activities

- Initiate development of innovative fuel systems that possibly support alternative fuel cycles to the current UOx once-through fuel cycle with the potential for dramatic performance and waste minimization potential.
- Initiate development of advanced high performance particle based fuel systems including the thermal “deep burn” concept.
- Continue pursuit of fuel cladding material development for both thermal and fast reactor use to achieve major increase in irradiation tolerance characteristics, opening the door to overall “deep burn” concepts.
- Collaborate with the Advanced Reactor Concepts program on nuclear data measurements and validation activities that support advanced fuel development activities.
- Continue to explore innovative fuel designs with long-term, high performance.
- Continue the development of transmutation fuels in coordination with long-term separations R&D and systems analysis.

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

- Initiate R&D on fuel resources including uranium and thorium resource estimates, advanced exploration methods, and methods to improve resource recovery efficiencies.
- Complete an analysis to characterize long-term uranium resources, including economic considerations and technical barriers. This study would also include an evaluation of the utilization of low-grade or unconventional resources (e.g., phosphates, seawater, etc.).

	FY 2009	FY 2010	FY 2011
Transmutation Research and Development	**28,394**	**4,288**	**0**

The mission of the Transmutation technical area was to convert long-lived radioactive isotopes into shorter-lived elements. Transmutation can lower the long-term radiotoxicity of used nuclear fuel to below that of mined uranium ore by reducing the time for decay from hundreds of millennia to as little as centuries.

In the context of long-term waste management technology R&D, this activity supported research on advanced instruments and measures as well as analyses of highly accurate nuclear data such as neutron fission and captures cross-sections for elements of interest to the Fuel Cycle R&D program. Improved accuracy of nuclear data is important to a variety of activities including transmutation performance analysis, safeguards instrumentation design, high-burnup fuel development, waste package performance, and development of advanced models and simulation codes. Nuclear data research will be performed in collaboration with SC.

In FY 2009, the Department:

- Continued R&D activities on high precision measurements of nuclear data, sensitivity analyses to reduce uncertainty, and development of advanced measurement techniques.
- Continued the development of advanced materials that will significantly improve the performance of nuclear systems.
- Continued to work collaboratively with the international community to efficiently leverage existing infrastructure.

In FY 2010, the Department is:

- Continuing R&D activities on high precision measurements of nuclear data, sensitivity analyses to reduce uncertainty, and development of advanced measurement techniques.
- Updating nuclear data libraries to include reduced uncertainties based on new data in the fast neutron region of the spectrum.

In FY 2011, the Department will:

- Focus on separations of fast reactor fuels, transmutation fuels, and systems analysis of fuel cycles containing fast reactors and be funded under those technical areas.

	FY 2009	FY 2010	FY 2011
Modeling and Simulation	**24,845**	**26,009**	**15,570**

The mission of Modeling and Simulation within NE is to create and deploy science-based, verified and validated modeling and simulation capabilities essential for the design, implementation, and operation of all aspects of nuclear energy systems and their nuclear fuel cycles to improve U.S. energy security. Program activities encompass the micro-behavior level of fuels and materials in Fuel Cycle R&D, to the macro-behavior level of reactor systems (e.g., LWRs and advanced reactors in Reactor Concepts RD&D)

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

and their fuel cycles. The successful application of these advancements will enable the use of computer simulation in a fundamentally new way for design, licensing, and operation of nuclear systems.

These activities differ from those conducted in conjunction with the Energy Innovation Hub for Modeling and Simulation within the Nuclear Energy Enabling Technologies program. While modeling and simulation activities carried out in the Reactor Concepts RD&D and Fuel Cycle R&D programs are focused on building new advanced modeling and simulation capabilities in the areas of nuclear fuels, separations processes, material safeguards, waste forms, and repositories for near-term, mid-term, and long-term nuclear power system concepts, the Hub will have a narrower focus of validating and demonstrating the application of modeling and simulation capabilities through the virtual modeling of an existing operating reactor. Additionally, the Hub will be managed by an independent consortium and while the Hub activities may complement those in the NE program, they are not directly linked to the activities proposed under Fuel Cycle R&D and Reactor Concepts RD&D.

In FY 2009, the Department:

- Expanded code team efforts to develop a fast reactor design code to couple thermal-hydraulics, neutronics and structural mechanics with three-dimensional capabilities.
- Improved the fidelity of thermo-mechanical codes used for fuel modeling and improving the models of multi-component materials used in reactor fuels.
- Developed code architectures and methods to model the performance of advanced waste forms in adverse geological environments for very long-term storage and disposition.
- Initiated the development of simulation codes to model the used nuclear fuel recycling process to improve our understanding of what is needed to better design recycling processes with integrated advanced safeguards.
- Developed a Unified Markup Language specification for a modeling and simulation interoperability framework that will facilitate the transfer of capabilities from the research environment to the engineers who will design, build, and operate the new nuclear energy systems.
- Delivered Fundamental Models and Methods that will allow the understanding of performance of materials on the lower length scales needed to simulate the performance of integrated systems.
- Delivered an initial modeling and simulation integration framework that facilitates capability transfer by allowing interoperability of existing codes, industry codes, and newly developed capabilities.
- Provided a centrally planned, but distributed, set of computational resources that leverages other Department of Energy (DOE) high performance computing programs and is needed to support the application development and use.
- Developed a set of experimental data needs and requirements over the entire spectrum of time- and length-scale for the models.
- Developed the set of validation techniques necessary for demonstrating the quality of the modeling tools and for defining requirements for further development of these tools.
- Issued a competitive solicitation to award mission-specific R&D projects to universities.
- Awarded competitive contracts to enhance university infrastructure and increase human capital developmental programs for nuclear engineers and scientists.

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

In FY 2010, the Department is:

- Delivering the first generation of integrated performance and safety codes to provide a limited science based understanding of the performance of nuclear fuels and reactor core and safety systems.
- Establishing projects with universities, industry, and laboratories to deliver fundamental material performance models to the integrated code activities.
- Completing surveys of existing verification, validation, and uncertainty quantification methodologies and beginning to implement the most appropriate ones.
- Creating a prototype application that provides a systematic approach to meeting security requirements by integrating the safeguard systems and separations process.
- Developing an initial three-dimensional, high-resolution, integrated system application to understand and predict the performance of nuclear waste forms in repository environments.

In FY 2011, the Department will:

- Deliver advancements for the integrated performance and safety codes for nuclear fuel that remove empirical based behaviors and replace them with first principle based science.
- Continue projects with universities, industry, and laboratories to deliver fundamental material performance models to the integrated code activities.
- Deliver first generation of codes to simulate waste forms in a repository environment and the operation of safeguard systems in a separations facility.
- Create a prototype application that provides a systematic approach to meeting security requirements by integrating the safeguard systems and separations process.
- Implement advanced verification, validation, and uncertainty methodologies.
- Develop an initial modeling and simulation integration framework that facilitates capability transfer by allowing interoperability of existing codes, industry codes, and newly developed capabilities.
- Provide a centrally planned but distributed set of implemented computational resources that leverage other DOE high-performance computing programs needed to support applications development and use.

	FY 2009	FY 2010	FY 2011
Systems Analysis and Integration	**20,083**	**14,783**	**15,664**

The mission of the Systems Analysis technical area is to perform systems engineering and integrating analyses of nuclear energy and fuel cycle systems to inform fuel cycle R&D, programmatic decisions, strategy formulation, and policy development.

The technical integration program element provides support in the areas of technical integration, project controls, quality assurance, document management, knowledge management, and communications. This function ensures the technical consistency of the program, integrated product development, and planning and monitoring of work activities.

In FY 2009, the Department:

- Conducted a study of nuclear fuel cycle management options that was focused on identifying a very broad range of possible options for used fuel storage, recycling, waste disposal (including pathways for options that would require significant scientific breakthroughs), and specified criteria for each key technical and scientific challenge.

- Designed and assessed specific technical options and trade studies for future fuel cycle systems such as assessment of approaches for minor actinide and heat management.
- Revised quality assurance program to better reflect National Quality Assurance -1 guidance and increased collaborations with industry and universities.
- Began development of knowledge management processes that permit historical sodium reactor data to be available on line to program researchers.

In FY 2010, the Department is:

- Performing systems analyses, optimization studies, and trade studies. Defining sensitivity coefficients with respect to system level assumptions to guide the R&D prioritization effort.
- Providing strategic and program planning support in developing technology roadmaps, integrated schedules, and other planning documents.
- Developing and maintaining a set of tiered models to be used for policy level decision making.
- Expanding knowledge management to include historical fuels data and geologic repository data and reports.
- Developing specifications and requirements for a fuel cycle simulator that can synthesize and visually present multi-variable attributes of potential fuel cycles.

In FY 2011, the Department will:

- Use a systems engineering approach, conduct systems analyses to define and analyze a broad variety of innovative fuel cycle options including analyzing the effects of a variety of alternative disposal geologies to inform R&D prioritization and program planning.
- Develop a directory of innovative fuel cycle options that documents key characteristics.
- Continue knowledge management activities related to historical fuels data and geologic repository data and reports.
- Continue development of a fuel cycle simulator to support future decision making.
- Perform trade studies and systems analyses to develop information and data on newly-defined innovative fuel cycles to inform program planning and R&D prioritization efforts.

	FY 2009	FY 2010	FY 2011
Materials Protection, Accountancy, and Controls for Transmutation	**0**	**6,826**	**7,814**

The mission of the Materials Protection, Accountancy, and Controls for Transmutation (MPACT) technical area is to develop technologies and analysis tools to enable next generation nuclear materials management for future U.S. nuclear fuel cycles to prevent diversion or misuse, thereby, reducing proliferation risks and enhancing confidence and acceptance of nuclear energy. One challenge MPACT will focus on is to develop online, real-time, continuous, accountability instruments and techniques that permit at least an order of magnitude improvement in the ability to inventory fissile materials in domestic fuel cycle systems in order to detect diversion and prevent misuse.

Work within this technical area will be closely coordinated with work described in NE's Enabling Technologies program but will focus specifically on informing future fuel cycle and safeguards R&D. Work will continue to be closely coordinated with NNSA programs.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

In FY 2010, the Department is:
- Identifying gaps and areas for improving proliferation risk assessments of nuclear fuel cycles and drafting a roadmap outlining the path forward.
- Initiating the development of technologies to provide online, real-time measurement systems, including process-monitoring capabilities for improving material accountancy and reduced proliferation risk associated with advanced fuel cycle systems.
- Initiating the development of methodologies to incorporate safeguards and security systems into advanced fuel cycle systems to reduce proliferation risk, optimize performance, and reduce costs.

In FY 2011, the Department will:
- Based on the roadmap created in FY 2010, continue development of improved proliferation risk assessment tools to evaluate fuel cycle options.
- Continue to develop technologies to provide online, real-time measurement systems, including process-monitoring capabilities for improving material accountancy and reduced proliferation risk associated with advanced fuel cycles.
- Continue to develop methodologies to incorporate safeguards and security systems into advanced fuel cycles to reduce proliferation risk, optimize performance, and reduce costs.
- Develop an integrated safeguards and separations design framework using advanced modeling and simulation to inform and guide safeguards technology development and process design.

	FY 2009	FY 2010	FY 2011
Used Nuclear Fuel Disposition	**0**	**9,124**	**45,000**

The mission of the Used Nuclear Fuel Disposition technical area is to identify alternatives and conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles. The challenge for Used Nuclear Fuel Disposition is the development of storage, transportation, and disposal systems resulting in near-zero radionuclide releases. Work in this program element supports all three fuel cycle approaches; once-through fuel cycle, modified open fuel cycle, and full fuel recycle. NE will oversee ongoing responsibilities under the Nuclear Waste Policy Act. Within the Fuel Cycle R&D program, these include activities associated with nuclear waste management.

In FY 2010, the Department is:
- Developing capabilities for analyses and trade studies to evaluate all aspects of storage and disposition scenarios and to provide rapid response capability as needed.
- Developing the technical bases and lessons learned for used nuclear fuel disposition.
- Developing modeling tools and initiating systems modeling for engineered and natural barrier systems and generic disposal concepts in multiple environments.
- Initiating an modeling and simulation experiment and testing program.

In FY 2011, the Department will:
- Provide technical expertise to inform policy decision-making regarding the management of used nuclear fuel and radioactive waste that would be generated under existing and potential future nuclear fuel cycles, in collaboration with Office of Environmental Management.
- Develop commercial used fuel and DOE high-level waste projection databases for consistency

(dollars in thousands)		
FY 2009	FY 2010	FY 2011

in the amounts, locations, discharges and timeframes for systems analysis for the policy decision process.
- Provide rapid response support for inquiries from the proposed Blue Ribbon Commission.
- Work with the EPA and NRC on to help ensure regulatory frameworks can accommodate waste forms and disposition paths not yet defined.
- Develop a systems model to perform cost-benefit analysis of the variety of waste forms, storage concepts, transportation options, and disposal options to provide to policy makers.
- Develop a lessons learned effort that evaluates the critical components of both the international and the past U.S. policy for nuclear waste to inform decision makers.
- Develop a comprehensive understanding of the current technical bases for storage and transportation of used nuclear fuel and high-level nuclear waste; then identify opportunities for long-term R&D.
- Develop a fundamental understanding of the performance of potential storage system concepts over many decades for a variety of used nuclear fuel types and radioactive waste forms based on simulation and experiment.
- Evaluate and model the effects of a wide range of factors that could impact long term storage including cladding behavior, helium buildup, and marine environments.
- Conduct R&D related to data and modeling needs to ensure security over long periods of storage and future transportation.
- Evaluate technical capability of dual purpose canisters to be transported after long-term storage with consideration of regulatory requirements.
- Investigate techniques for repackaging nuclear materials after long periods of storage.
- Develop and test new techniques for monitoring of nuclear materials during long-term storage and new techniques for non-destructive examination.
- Prepare for qualification of new types of nuclear fuel and new waste forms in shipping casks.
- Develop a features, events, and processes database, beginning with international databases and expanding as required to include additional disposal media and/or disposal concepts.
- Develop enhanced databases and other tools for the management and analysis of activities related to domestic used fuel management.
- Develop a comprehensive understanding of the current technical bases for geologic disposal of used nuclear fuel and high-level nuclear waste; then identify opportunities for long-term R&D.
- Conduct R&D advanced models of disposal options to evaluate a variety of used nuclear fuel and high-level waste forms emplaced in a variety of geologic disposal media such as granite, tuff, deep boreholes, clay, shale, salt, and basalt.
- Initiate validation of these advanced models by measuring the thermomechanical, hydrological, and chemical properties of selected geologic media in laboratory experiments and field tests.
- Evaluate and model the inclusion of low-level waste with various high-level waste disposal options.

	FY 2009	FY 2010	FY 2011
Modified Open Cycle	**0**	**0**	**40,000**

The FY 2011 budget expands the focus of the Fuel Cycle R&D program to include fuel cycle strategies beyond a full fuel recycle system. The modified open cycle constitutes a range of technology options in between the once-through and full recycle strategies and could be an important part of achieving a sustainable fuel cycle. All three fuel cycles need to be studied in order to provide future decision-makers with a full range of options for making decisions on the best way to manage used fuel. Full recycle has been the focus of the Fuel Cycle R&D program to date and the once-through fuel cycle is the current practice in the United States. The modified open cycle has not been studied as thoroughly as the other two options and that is why it is being singled out as a new technical area for FY 2011.

As a potential waste management option in the long-term if economically viable, a modified open cycle could involve limited used fuel conditioning or processing and would have a higher uranium utilization than the once-through cycle, though not as high as the full recycle option. Similar to other fuel cycle approaches, the modified open cycle would still require a repository for disposal of high level waste for hundreds of thousands of years. A key challenge in this area is to accomplish minimum used fuel conditioning or separations in order to keep costs and proliferation risk low.

In FY 2011, the Department will:

- Identify novel fuel forms, ultra-high burnup fuels, thorium-based fuels, deep burn of transuranic-bearing tristructural isotropic fuels, new advanced reactors designed for transuranic burnup such as molten salt reactors and travelling wave reactors, and options to declad and reclad used fuel to allow volatile and gaseous fission products to be removed and captured before recycling.
- Initiate the exploration of limited treatment of used fuel to add more fuel material to the used fuel, remove wastes from the fuel that inhibit the nuclear reactions, and repair or replace the cladding that contains the fuel.
- Initiate systems engineering to define, establish requirements for, and evaluate modified open fuel cycle options.
- Initiate systems analyses to provide needed information on such topics as transuranic management, separations and partitioning efficiency, fission product behavior, materials reuse, and transmutation approaches of modified open fuel cycle systems.
- Initiate the research and analysis of limited fuel treatment processes, waste forms resulting from limited fuel treatment processes, and advanced transmutation concepts.

SBIR/STTR	**0**	**3,704**	**5,628**

The FY 2010 and FY 2011 amounts shown are an estimate of the requirement for the continuation of the SBIR and STTR program.

Total, Fuel Cycle Research and Development	**142,652**	**136,000**	**201,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Separations and Waste Forms The decrease from $41,615,000 to $31,324,000 reflects: ▪ The transfer of Experimental Breeder Reactor-II used nuclear fuel treatment to the Idaho Facilities Management program. ▪ Activities related to materials protection, accountancy, and controls for transmutation have been consolidated into a new activity.	-10,291
Advanced Fuels The increase from $29,651,000 to $40,000,000 reflects an increase in scope to expand R&D from primarily transmutation fuels to a multitude of fuel types.	+10,349
Transmutation Research and Development The decrease from $4,288,000 to $0 reflects the transfer of this activity to other technical areas such as separations, advanced fuels, and systems analysis.	-4,288
Modeling and Simulation The decrease from $26,009,000 to $15,570,000 reflects the transfer of much of the code development and experimental support activities to the technical areas in reactors, fuels, separations and waste forms. In addition, a portion of the Nuclear Energy Advanced Modeling and Simulation support element development will be cost-shared with the Reactor Concepts RD&D program.	-10,439
Systems Analysis and Integration The increase from $14,783,000 to $15,664,000 reflects increases to conduct systems engineering and more analyses comparing the three fuel cycle options. These increases are partially offset by sharing the technical integration function with the Reactor Concepts RD&D program.	+881
Materials Protection, Accountancy, and Controls for Transmutation The increase from $6,826,000 to $7,814,000 reflects a ramping up of activities related to the development of measurement systems and M&S tools.	+988
Used Nuclear Fuel Disposition The increase from $9,124,000 to $45,000,000 reflects a large increase in scope of waste management R&D.	+35,876
Modified Open Cycle The increase from $0 to $40,000,000 reflects the introduction of a new technical area to support R&D for the modified open cycle option, one of three fuel cycle options being studied by Fuel Cycle R&D.	+40,000

	FY 2011 vs. FY 2010 ($000)
SBIR/STTR The increase from $3,704,000 to $5,628,000 reflects an increase in R&D expenditures subject to SBIR and STTR.	+1,924
Total Funding Change, Fuel Cycle Research and Development	**+65,000**

Nuclear Energy Enabling Technologies
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Nuclear Energy Enabling Technologies	0	0	0	99,300

Mission

The mission of the Nuclear Energy Enabling Technologies (NEET) program is to develop crosscutting technologies that directly support and complement the Office of Nuclear Energy's (NE) development of new and advanced reactor concepts and fuel cycle technologies and to encourage the development of transformative, "outside-the-box" solutions across the full range of nuclear energy technology issues. The program will focus on innovative research relevant to multiple reactor and fuel cycle concepts that offer the promise of dramatically improved performance. Crosscutting areas of inquiry include the development of advanced fuels and reactor materials, research on innovative nuclear manufacturing methods, new sensor technologies for monitoring material, and equipment conditions in existing reactors and creative approaches to further reduce proliferation risks. The investigator-initiated, peer reviewed program will be open to projects that relate to any aspect of nuclear energy generation - reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth - ensuring that good ideas have sufficient outlet for exploration. In addition, NE will support research and development (R&D) on transformative, high-risk high-reward concepts that have the potential for making significant leaps forward in advanced nuclear technology development. This effort will cover the full nuclear technology spectrum. Finally, the Energy Innovation Hub for Modeling & Simulation (HUB) will provide crosscutting support to facilitate future improvement of nuclear technologies. Technical innovations emerging from the NEET programs will be used to advance the Reactor Concepts Research, Development and Demonstration (RD&D) and Fuel Cycle R&D programs.

Benefits

Pursuing crosscutting and transformative nuclear technologies and capabilities for incorporation into advanced reactor and fuel cycle concepts offers the promise of revolutionary improvements in safety, performance, reliability, economics and proliferation risk reduction, and promotes creative solutions to the broad array of nuclear energy problems related to reactor and fuel cycle development. The activities undertaken in this program complement those within the Reactor Concepts RD&D and Fuel Cycle R&D programs by providing a mechanism for pursuing broadly applicable R&D in areas that may ultimately benefit specific reactor and fuel cycle technology development. Leveraging the knowledge generated through activities in the NEET program will provide useful information for program and strategic planning and will allow NE to address key challenges affecting nuclear reactor deployment (e.g., capital cost, technology risks and proliferation concerns).

Annual Performance Results and Targets

The NEET program's performance measure aligns to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the GPRA Unit Program Goal of New Nuclear Generation Technologies. Measures for the NEET program are under development but will support progress in these areas.

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: New Nuclear Generation Technologies

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**

FY 2011 Efficiency Performance Measure: *Maintain total administrative overhead costs in relation to total R&D program costs of less than 8 percent.*

T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:

Crosscutting Technology Development FY 2011 Effectiveness Performance Measure: Measures Under Development. New measures for this new program will be finalized and in place by the start of FY 2011.

T: none A: NA	T: none A: NA	T: none A: NA	T: none A: NA	T: none A: NA	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:	T: 1 A:

Means and Strategies

The NEET program will use various means and strategies to achieve its GPRA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- Develop crosscutting, transformative technologies that directly support and complement NE's development of new and advanced reactor concepts and fuel cycle technologies.
- Partner with the national laboratories, industry, and university research communities as well as the international research community through various multilateral and bilateral international agreements and pursue cost-sharing agreements where appropriate.
- Evaluate improvements in other industrial sectors (aerospace, shipbuilding, etc.) to identify potential transformational technology ideas to be applied to the research, development, and deployment of nuclear energy technologies.
- Solicit and competitively select projects to conduct research on advanced manufacturing technologies.

The Department will implement the following strategies:

- NE will establish the Hub in FY 2010 and will continue to support it in FY 2011. The Hub will transform the way in which the United States develops, implements, and licenses nuclear energy technologies through the application of state-of-the-art computer modeling and simulation of all processes from the sub-atomic to the system-integration level.
- NE's R&D programs will partner with the private sector, national laboratories, universities, and international partners to develop crosscutting advanced nuclear technologies.
- Programs will also engage the international community in pursuit of advanced nuclear technology that will benefit the U.S. with enhanced safety, improved economics, and reduced production of wastes.
- R&D will use a "science-based" approach that involves the close coupling of experiments, theory, and advanced modeling and simulation to create new levels of understanding about the performance and safety of complex physical systems.
- Open competition for new ideas through broad solicitation of novel and transformative concepts for any technology or system that might contribute to nuclear power, from enrichment to fuel management.
- NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions, through open, competitive solicitations for investigator-led projects.

The following external factors could affect the program's ability to achieve its strategic goal:

- Deployment of advanced reactor technologies may be influenced by Administration policy decisions related to advanced spent fuel and waste management technologies (e.g., Secretarial Blue Ribbon Commission on nuclear waste management).
- The decision to build new commercial nuclear power plants rests with the power industry alone. This decision depends in part on power demand and economic and environmental factors beyond the scope of the Department's programs. In the near term, it depends on complex economic decisions made by industrial partners.

In carrying out the program's mission, the program performs the following collaborative activities:

- NE supports the Modeling and Simulation Hub in its NEET program. The NEET program will work closely with the Office of Science to ensure synergy and avoid redundancies.
- The Department will consult with the NRC on program planning to assure that their R&D activities are complimentary, cost effective, and not duplicative.
- The program will work to receive broad international cooperation and support, consistent with the objectives of the program.
- NE will partner with industry, research and standards groups, where appropriate, in a cost-shared manner to conduct research, technology development and ensure industrial codes and standards are valid and up to date.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts RD&D and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders in a number of recent evaluation activities to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences.

Nuclear Energy Enabling Technologies
Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Nuclear Energy Enabling Technologies			
Crosscutting Technology Development	0	0	43,332
Transformative Nuclear Concepts Research and Development	0	0	28,888
Energy Innovation Hub for Modeling and Simulation[a]	0	0	24,300
SBIR/STTR	0	0	2,780
Total, Nuclear Energy Enabling Technologies	0	0	99,300

Benefits

The Nuclear Energy Enabling Technologies program includes three budget elements. The Crosscutting Technology Development activity provides crosscutting R&D support for the various nuclear energy concepts (existing and future) in areas such as advanced fuels and reactor materials, innovative nuclear fabrication and construction methods, new sensor technologies for monitoring material and equipment conditions in existing reactors, and creative approaches to further reduce proliferation risks. The Transformative Nuclear Concepts R&D will support, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration. The Energy Innovation Hub for Modeling and Simulation will apply existing modeling and simulation capabilities to create a "virtual" reactor user environment for engineers to simulate a currently operating reactor. This approach will provide a detailed, validated reactor performance predictive capability for use by engineers to address performance and safety issues related to power "uprates" and life extensions for current reactors. Collectively, these activities complement activities within the Reactor Concepts RD&D and Fuel Cycle R&D programs, by addressing challenges that are not specific to particular reactor or fuel cycle technologies. Elements of this program will be subject to peer review. Crosscutting activities previously carried out in other NE R&D programs are now within the scope of this program to avoid duplication of effort.

A balanced science-based R&D approach includes both performance enhancement of evolutionary concepts and investigation of crosscutting and novel concepts. These elements will further promote the generation of new ideas and foster exploration of new and original technology options. The research on transformative nuclear concepts will pursue non-traditional nuclear energy ideas that offer the potential for improved system performance and may radically alter nuclear system configuration and development needs. This could include the development of specialized nuclear fuels, revolutionary materials, new enrichment techniques, tailored coolants, new techniques for energy conversion, or other innovations. Some examples of radical changes could be utilization of non-solid fuel forms or replacement of the conventional steam cycle. Including these transformational technologies into integrated system concepts is vital for the stimulation of refined concepts and systematic comparison of long-term options.

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[a] In FY 2010, funding for the Energy Innovation Hub for Modeling and Simulation was included in the Generation IV Nuclear Energy Systems program.

Incorporating these technologies and capabilities as part of an integrated system offers the promise of revolutionary improvement in safety, performance, reliability, economics and proliferation risk reduction. Advances in these enabling technologies could reduce capital and operating costs, increase plant efficiency and reliability and improve the overall economics of nuclear energy. Better understanding and quantification of proliferation risks will improve the technical and policy choices associated with the nuclear fuel cycle. Improved material performance has the potential to enable greater reactor temperatures, new reactor designs, and/or new reactor missions. New classes of alloys and materials, not yet considered for reactor performance, may enable transformational reactor performance. Improving the accuracy of nuclear data and the use of advanced modeling and simulation tools and capabilities will contribute to improved safety and improved design processes without unneeded conservatism.

Generally, NE programs allocate R&D funding to those entities (e.g., industry, laboratories, and universities) that are best qualified to carry out the work in support of NE's mission. Consistent with NE's commitment to supporting R&D activities at university and educational research institutions, NE designates up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions. In addition, the Transformative Nuclear Concepts R&D activity will make funds available for investigator-initiated projects through open and competitive solicitations designed to encourage broad participation across national laboratories, universities, research institutions, and industry.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Crosscutting Technology Development	**0**	**0**	**43,332**

Crosscutting Technology Development provide either crosscutting or enabling technologies to support multiple reactor concepts in the areas including reactor materials, advanced methods for manufacturing, new sensor technologies for monitoring material and equipment conditions in existing reactors, and creative approaches to further reduce proliferation risks.

Reactor Materials – New classes of alloys and materials, not yet considered for reactor performance may enable transformational reactor performance. The custom design of innovative steels using modern materials science techniques, industrial knowledge, and previous experience can improve performance over traditional materials by a factor of five to ten, increasing the maximum operating temperature by 200 degrees Celsius for a period of at least 80 years. Concepts that may be evaluated include optimized alloy composition, engineered microstructures, age-tempered microstructures, or combinations thereof. Other, more radical concepts that may be explored to enable even greater performance include bi-metallic layers, metal/ceramic composites, ion-beam or surface-modified alloys. A wide range of operating conditions will be considered, with the general goal of improved strength and radiation resistance.

In FY 2011, the Department will:

- Create and analyze small samples to verify material properties, and separate effects testing will assess key environmental effects.
- Evaluate and prioritize innovative structural materials (e.g., oxide dispersion strengthened, nano-structured ferritic materials, and nano-cluster dispersion materials) for use in radiation environment and other high temperature applications.
- Consider approaches such as the use of ion beams to simulate accelerated aging of materials.
- Develop collaborations with industry, universities, and/or domestic/international agencies using competitive processes and cost-sharing arrangements as appropriate.
- Coordinate and integrate materials development activities with modeling and simulation and reactor component and system development to optimize the performance with the service requirements.

Proliferation Risk Assessment – The program will develop new tools and approaches for understanding, limiting, and managing the risks of proliferation and physical security for fuel cycle options. NE, in collaboration with National Nuclear Security Administration, will focus on assessments required to inform domestic fuel cycle technology and system option development, partnering with other organizations to share results of assessments. These analytical/predictive tools for comprehensive proliferation risk assessments will provide important information for discussions and decisions regarding fuel cycle options. These assessments will:

- Exploit science-based approaches for analyzing difficult-to-quantify proliferation risk factors or indicators (e.g., capabilities, motivations and intentions); address issues identified in several National Academy of Sciences studies related to risk assessment; and leverage current state-of-the-art academic research in this field.
- Evaluate the diverse decision factors (including economics, public health and safety, public

perceptions, environmental benefits and proliferation and terrorism risk reduction) for different fuel cycle options to understand the tradeoffs and potential synergies between these decision criteria.

- Apply these tools to study nuclear energy system options and display the results in a useful format for decision makers.

In FY 2011, the Department will:

- Develop a detailed project plan for quantification of proliferation risk to include scope of work, steering committee and external review plans, and evaluation of nuclear energy's role in a broader national and international security context.
- Initiate studies of current risk assessment methodologies (strengths, key components, scopes, applicability) to include: 1) current methodologies in "prototype scenarios"; and 2) effective coordination with other national security (including counter terrorism and game theory) methodologies and entities (DHS, DARPA, etc.).

Advanced Methods for Manufacturing - This task will include research on advanced manufacturing technologies. This effort will draw upon successful practices in the oil, aircraft, and shipbuilding industries, as appropriate, and employ the modeling and simulation capabilities of the national laboratories to validate and optimize new technologies. The technologies and techniques researched will be independent of reactor type and broadly applicable to industry.

In FY 2011, the Department will:

- Initiate competitively selected high-potential R&D activities that improve nuclear plant manufacturing efficiency with universities, industry and laboratories in hybrid gas metal arc and laser welding; Automated Non-Destructive Examination techniques such as digital radiography and phased array ultrasonic; steel concrete composite structures; and prefabricated modular rebar assemblies.

Advanced Sensors and Instrumentation – This task will conduct necessary R&D unique sensor and instrumentation infrastructure technology to monitor and control new advanced reactors and small modular reactor systems. The unique operating conditions and fluids, upset and accident conditions, and degradation and aging phenomena (e.g. multiple units, very high temperature, and liquid metal) that are inherent to advanced and small modular reactor systems will require advancement in sensor, infrastructure and control technology to enhance nuclear plant safety and performance. It is expected that some of the development work will provide useful information for measurement, sensing, and materials accountability in waste management and fuel cycle arenas as well.

In FY 2011, the Department will:

- Perform research to develop advanced sensors to improve physical measurement accuracy and reduce uncertainty.
- Perform research on adaptive digital monitoring and control technology to provide increases in control system performance and self calibration capability.
- Perform research on fiber optic and wireless digital instrument communication systems.
- Perform research on highly integrated control system architectures for multiple reactor module

control.

Transformative Nuclear Concepts Research and Development 0 0 **28,888**

This program will support, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration. One goal of this effort is to encourage the identification and development of "outside the box" options in all aspects of the civilian nuclear energy program. The scope of eligible topics is not specific to any on-going, mission activities. NE funds mission-specific activities through investigator-initiated and directed research mechanisms within its other R&D activities; this includes support for universities and research institutions.

This effort is a key mechanism in NE's R&D portfolio to further encourage out-of-the-box thinking and promote creative solutions to the universe of nuclear energy challenges and questions. By pursuing novel and transformative concepts across all aspects of nuclear technologies, the projects funded under this activity may ultimately enable NE to make significant leaps forward in advanced nuclear technology development. This program is not focused on bringing nuclear concepts to the prototype stage.

In FY 2011, the Department will:

- Make available through open and competitive solicitations designed to encourage broad participation across national laboratories, universities, research institutions, and industry. Awards will likely span 2-3 years, depending upon project scope. Applications will be peer-reviewed by a body of internal and external experts to help select promising concepts, and to ensure that activities are not duplicative of any existing R&D activities. NE will monitor progress, utilize results to inform and adjust its program and activity planning and strategy development, and ultimately consider the outcomes of funded activities within the context of its mission-specific activities.

Energy Innovation Hub for Modeling and Simulation 0 0 **24,300**

The national priorities for NE include working with industry and the existing reactor fleet to safely uprate power and to extend the reactors operating life. In addition, NE undertakes R&D to advance new nuclear energy technologies. This includes the Generation III+ and IV reactor systems as well as the development of small modular reactors. Advanced modeling and simulation is an essential tool to improving our scientific understanding of these systems to safely increase the pace of innovation and reduce costs.

One of the greatest challenges facing the designers and engineers for the Generation III+ and Generation IV reactors in using advanced modeling and simulation is the "user interface" required to access greater computing power. The current user interface for these tools and computers was created for work in the discovery sciences domain; a domain characterized by a small number of highly educated users, running a limited number of jobs for long periods on very powerful computers. In contrast, the applied domain of designers and engineers is characterized by a large variety of users running a plethora of jobs for short periods on very low power computers (e.g. desktops).

(dollars in thousands)

FY 2009	FY 2010	FY 2011

The focus of the Hub will be on dramatically changing the user environment for advanced modeling and simulation and high performance computing. The result will increase the pace of innovation, lower costs, and reduce uncertainty and risk for the design of reactors. The Hub will integrate and simplify the use of a wide range of technologies needed to use high performance advanced modeling and simulation by employing a cross-disciplinary team of nuclear engineers and scientists, computer scientists, mathematicians, verification and validation specialist and other experts.

To achieve the highest degree of success the Hub will be mission driven. The mission focus of the Hub is to create a "virtual" model of an operating reactor with the potential coupling of a physical reactor for validation and verification purposes. This will involve the use of existing appropriate capabilities, the integration of existing and new modeling and simulation capabilities via an interoperability framework, the development of additional modeling and simulation capabilities as needed, and the validation of the capabilities using data obtained from the operating reactor. This will allow the creation of advanced user environments to provide interface with the virtual model. Also, where needed, the Hub will develop new 3D science-based modeling and simulation capacities that are usable on advanced computing architectures. The Hub will also provide opportunities for fundamental and applied research that will combine experiments, theory and modeling and simulation to better understand nuclear energy technologies. The exact scope of work to be performed by the Hub will be, however, defined by the successful applicant.

The Hub will accelerate the validation of modeling and simulation of nuclear energy technologies, develop advanced approaches to demonstrate the "predictability" of advanced modeling and simulation, and implement advanced instrumentation to observe the operation of physical nuclear energy technologies. A great deal of work has been accomplished or is currently underway to build, verify, and validate the modeling and simulation capabilities needed for nuclear energy. The Hub will serve a valuable and unique role that supplements this work by focusing on an existing reactor, focusing on engineering "usability issues" for advanced modeling and simulation, and allowing an opportunity for national laboratories, universities, and industry to work in a highly collaborative environment focused on a single mission.

The Department anticipates that the benefits of the Hub will extend to all other forms of energy. The same user environment needed by nuclear energy technology designers and engineers will be usable by other energy technologies (e.g. solar, wind, and biomass energy systems). The user environment has the potential to transform advanced modeling and simulation applied to traditional forms of energy such as coal, natural gas, and petroleum as well.

FY 2010 activities are discussed in the Gen IV budget.

In FY 2011, the Department will:

- Continue to fund the Energy Innovation Hub for Modeling and Simulation, established in FY 2010 under the Gen IV program, to accomplish its objectives according to the Hub's funding plan, including cost sharing if applicable.
- Establish an Energy Innovation Hubs Oversight Board to review the progress of the Hub's scientific program and its management structure, policies, and practices.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

- Provide ongoing review of the Hub's deliverables and performance.

	FY 2009	FY 2010	FY 2011
SBIR/STTR The FY 2011 amount shown is an estimated requirement for the continuation of the SBIR and STTR program.	**0**	**0**	**2,780**
Total, Nuclear Energy Enabling Technologies	**0**	**0**	**99,300**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Crosscutting Technology Development The increase from $0 to $43,332,000 reflects the creation of the new budget activity in FY 2011 to support the development of crosscutting technologies capable of supporting multiple reactor types and inclusion of activities previously funded within the Gen IV budget in FY 2010 (e.g., reactor materials).	+43,332
Transformative Nuclear Concepts Research and Development The increase from $0 to $28,888,000 reflects the creation of the new budget activity in FY 2011 to pursue novel and transformative, investigator-initiated concepts across the full spectrum of nuclear areas to help enable significant leaps forward in advanced nuclear technology development.	+28,888
Energy Innovation Hub for Modeling and Simulation The overall funding increase reflects the transfer of the Hub from the Gen IV budget to the NEET budget. In FY 2010, the Hub is funded at $21,384,000; the FY 2011 request reflects an increase of $2,916,000 to support on-going activities following from creation of the Hub in FY 2010.	+24,300
SBIR/STTR The increase from $0 to $2,780,000 reflects an increase in R&D expenditures subject to SBIR and STTR.	+2,780
Total Funding Change, Nuclear Energy Enabling Technologies	**+99,300**

Radiological Facilities Management
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Radiological Facilities Management				
Space and Defense Infrastructure	35,000	0	42,000	47,000
Research Reactor Infrastructure	6,146	0	10,000	4,818
Oak Ridge Nuclear Infrastructure	12,500	0	10,000	0
Los Alamos Nuclear Infrastructure	12,500	0	10,000	0
Pu-238 Production Restart Project	0	0	0	15,000
Total, Radiological Facilities Management	66,146	0	72,000	66,818

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)
P.L. 111-85, Appropriation Act (2010)

Mission

The Radiological Facilities Management (RFM) program maintains Office of Nuclear Energy (NE) managed nuclear facilities at the Idaho National Laboratory, Oak Ridge National Laboratory (ORNL), and Los Alamos National Laboratory (LANL), primarily housing large gloveboxes, hot cells, and their associated support facilities. These facilities are supported through the Space and Defense Infrastructure subprogram and support the production of radioisotope power systems. Beginning in FY 2011, DOE and the National Aeronautics and Space Administration (NASA) will initiate a project to restart the production of Plutonium-238 (Pu-238) for future NASA missions and potential national security applications. NE's Research Reactor Infrastructure program will continue to provide fresh reactor fuel services to operating university reactors that support nuclear energy research and development (R&D). Finally, in FY 2009 and FY 2010, NE supports Congressionally-directed infrastructure activities at ORNL and LANL.

Benefits

The RFM program ensures that the Department's nuclear capabilities supporting radioisotope power systems production are maintained and operated in a safe, environmentally-compliant and cost-effective manner to support those priorities and supports fuels management for university reactors. Key activities include managing all special nuclear materials contained in the Department of Energy (DOE) facilities, the management and disposition of all special nuclear materials under NE ownership contained in these facilities, and the new Pu-238 Production Restart Project. This Pu-238 Production Restart Project will be co-funded by DOE and NASA and will re-establish a domestic capability to produce Pu-238 to enable future NASA space missions and potential national security applications that require radioisotope power systems (RPSs). Existing supplies of Pu-238 are limited; domestic production will help ensure that Pu-238 is available beyond the next decade to meet NASA and national security users' long-term demand.

Isotope Development, Production, and Research

Isotope production at the DOE is primarily the responsibility of the Office of Science (SC) with two exceptions: Pu-238 production by NE and molybdenum-99 (Mo-99) production supported by the National Nuclear Security Administration's (NNSA's) Global Threat Reduction Initiative (GTRI).

The Isotope Development and Production for Research and Applications (Isotope) program located in SC's Nuclear Physics program offers more than 120 stable and radioactive isotopes for use in basic research and in medical diagnostic, medical treatment, national security, energy, and industrial applications. The Isotope program produces isotopes only where there is no U.S. private sector capability or where other production capacity is insufficient to meet U.S. needs. Isotope production for commercial use or repackaging is on a full-cost recovery basis, while isotopes produced solely for non-proprietary research purposes are provided at below cost. The Isotope program works in close collaboration with other Federal agencies and the isotope-using communities to develop priorities for production. This past year, the Nuclear Science Advisory Committee (NSAC) issued its report establishing priorities for the production of research isotopes in April 2009. A long-term strategic plan for the program came out in November 2009. Both reports were developed with Federal, commercial, and research community input. A current priority is the production of Helium-3 (He-3), used in neutron detection and cryogenics. Historically, He-3 has been a by-product of tritium production for the U.S. weapons program. With the reduction in nuclear weapons, tritium production is at a low level and current demand for He-3 has drawn down supplies. U.S. and international efforts are underway to address the He-3 supply shortfall.

For nearly 50 years, the NE's Space and Defense Power Systems program has maintained the capabilities needed to support the design, development, production, and safety of Pu-238 RPS for science missions to the outer planets, exploration of the moon and Mars, and potential national security applications. With a limited existing Pu-238 stockpile, NE is working to re-establish domestic Pu-238 production in order to assure continued availability of these power systems.

Mo-99 is widely used in medical diagnosis and has been produced commercially with reactors using highly enriched uranium (HEU) fuel. Because of the nonproliferation mission to remove HEU from use, NNSA's GTRI program has the lead for Mo-99. As part of its nuclear nonproliferation mission, and in light of the current Mo-99 supply shortage, GTRI is working to demonstrate Mo-99 production without the use of HEU. GTRI is implementing projects to demonstrate the viability of non-HEU based technologies for large-scale commercial Mo-99 production, including for example: accelerator technology, Low Enriched Uranium (LEU) target technology, LEU solution reactor technology, and neutron capture technology.

Annual Performance Results and Targets

The RFM program contributes to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the National Nuclear Infrastructure GPRA Unit Program Goal. The program's performance measure contributes to these goals by ensuring that the Department's unique facilities, required for advanced nuclear energy technology R&D, are maintained and operated such that they are available to support national priorities. Key activities conducted under this program include ensuring that all NE facilities meet essential safety and environmental requirements and are maintained at user-ready levels. Other key activities include the management and disposition of all special nuclear materials under NE ownership contained in these facilities, and providing support for university research reactors through fuel management and upgrading control system.

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: National Nuclear Infrastructure

FY PY-3	FY PY-2	FY PY-1	FY PY	FY CY	FY BY	FY BY+1	FY BY+2	FY BY+3	FY BY+4
FY 2006	**FY 2007**	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**	**FY 2012**	**FY 2013**	**FY 2014**	**FY 2015**

Efficiency Performance Measure: *Maintain total administrative overhead costs in relation to total R&D program costs of less than 8 percent.*

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A: Met	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:	T: < 8% A:

Effectiveness Performance Measure: To ensure unique nuclear facilities are available to support critical Departmental missions, maintain a facility operability index of 0.9 for key RFM program facilities.

(Beginning in FY 2010, this measure tracks RFM program facilities only. Idaho Facilities Management program facilities are tracked separately.)

FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015
T: 0.9 A: Met	T: 0.9 A: Met	T: 0.9 A: Met	T: 0.9 A: Met	T: 0.9 A:	T: 0.9 A:	T: 0.9 A:	T: 0.9 A:	T: 0.9 A:	T: 0.9 A:

Means and Strategies

The program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:
- Maintain the unique infrastructure and capability to deliver advanced RPS for space and national security missions.
- Aggressively implement contracting reforms, including fixed price competitive bidding, earned value management, capital planning processes in accordance with DOE Order 413.3A, independent external evaluations, etc., to ensure that the infrastructure program is operating effectively and efficiently to meet the Department's highest priority program needs.

The Department will implement the following strategies:
- Partner with the private sector, national laboratories, universities, and international partners to develop and deploy advanced nuclear technologies to increase the use of nuclear energy in the United States.
- Re-establish domestic Pu-238 production capability to address anticipated future supply shortages.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:
- Program infrastructure activities are interrelated with customer-defined (i.e., NASA and national security agencies) requirements for the development of RPS. Changes in long-term projected demands for RPSs would impact NE's provision of infrastructure and development support, including activities associated with restarting domestic Pu-238 production.

In carrying out the program's mission, the program performs the following collaborative activities:
- Coordinates with national security agencies and NASA in developing RPS for their use to ensure proposed systems and technologies satisfy the necessary technical requirements identified by customers for identified mission scenarios.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts Research, Development and Demonstration and Fuel Cycle R&D. NE infrastructure programs, such as the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders in a number of recent evaluation activities to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals.

NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as NSAC and National Academy of Sciences.

Space and Defense Infrastructure

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Space and Defense Infrastructure			
Idaho National Laboratory	9,500	9,840	9,840
Los Alamos National Laboratory	15,000	22,030	27,030
Oak Ridge National Laboratory	4,900	5,160	5,160
Other Activities	5,600	4,970	4,970
Total, Space and Defense Infrastructure	35,000	42,000	47,000

Benefits

The Space and Defense Infrastructure program produces plutonium 238 (Pu-238) based Radioisotope Power Systems (RPS) for National Aeronautics and Space Administration (NASA) mission and certain national security applications. The Department maintains capabilities at the Idaho, Oak Ridge, and Los Alamos National Laboratories needed to produce these systems.

The Pu-238 based RPS are needed for certain NASA and national security applications where other power sources, such as batteries, fuel cells, and solar technologies, are not economical or technologically viable. They enable NASA deep space missions that could lead to scientific discoveries, possibilities, and opportunities, as well as, support national security applications.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Idaho National Laboratory	**9,500**	**9,840**	**9,840**
▪ **Radioisotope Power Systems Assembly Operations**	**9,000**	**9,340**	**9,340**

Funding supports the facility manager, alternate facility manager, trained operators and maintenance staff, materials control, quality control, quality inspection, documentation, radiation health physicist support, radiation engineering, nuclear safety support, facility Documented Safety Analysis, mechanical and electrical engineering support, crane operations and maintenance, tooling and engineer development technical and equipment support, and overall program management including: training, transportation coordination, project management, shipping container hardware fabrication and repair, and drawing support. Idaho National Laboratory will store and maintain the flight quality status of the RPS for the NASA Mars Science Laboratory mission.

▪ **Capital Equipment for Radioisotope Power System Assembly Operations**	**500**	**500**	**500**

These funds support capital equipment used in RPS assembly activities.

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Los Alamos National Laboratory	**15,000**	**22,030**	**27,030**
▪ **Pu-238 Encapsulation and Scrap Recovery Facilities**	**12,000**	**20,030**	**25,030**

Funding supports maintenance and operation of dedicated Pu-238 processing, encapsulation, and scrap recovery facilities. The facilities include equipment and support capabilities to manufacture the fuel forms and weld them into fuel clads; chemically remove impurities from the fuel; support the required materials control, quality control, quality inspection and documentation, and overall program management which includes: training, transportation coordination, project management, and facility safety.

	FY 2009	FY 2010	FY 2011
▪ **Capital Equipment for the Pu-238 Facilities**	**3,000**	**2,000**	**2,000**

These funds support capital equipment related to the maintenance and operation of dedicated Pu-238 processing, encapsulation and scrap recovery facilities.

	FY 2009	FY 2010	FY 2011
Oak Ridge National Laboratory	**4,900**	**5,160**	**5,160**
▪ **Iridium Fabrication Facilities for Radioisotope Power Systems**	**4,400**	**4,410**	**4,660**

Funding maintains infrastructure and capabilities to fabricate iridium cladding and carbon insulators used to encapsulate and contain the fuel pellets necessary for the safe operation of RPS equipment and capabilities for the production of iridium clad vent sets used to encapsulate the fuel; equipment and capability for the production of thermal insulation sleeves used in the re-entry protection system; materials control, quality control, quality inspection, and documentation; and overall program management which includes: training, iridium inventory management, project management, and facility safety.

	FY 2009	FY 2010	FY 2011
▪ **Capital Equipment for Iridium Fabrication Facilities**	**500**	**750**	**500**

These funds support capital equipment associated with the capabilities to fabricate iridium cladding and carbon insulators.

	FY 2009	FY 2010	FY 2011
Other Activities	**5,600**	**4,970**	**4,970**
▪ **Safety/Program Analysis and Testing Infrastructure**	**4,610**	**4,670**	**4,670**

Funding supports the maintenance of the required analytical and testing capability which enables the Department to analyze RPS performance and safety for various applications.

	FY 2009	FY 2010	FY 2011
▪ **Certification of Type "B" Shipping Containers**	**990**	**300**	**300**

Funding supports Department of Energy certification of fuel and power system shipping containers.

	FY 2009	FY 2010	FY 2011
Total, Space and Defense Infrastructure	**35,000**	**42,000**	**47,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Los Alamos National Laboratory	
▪ **Pu-238 Encapsulation and Scrap Recovery Facilities** The increase from $22,030,000 to $27,030,000 is for the distributed facility charge that was initiated in FY 2010. The funds support engineering and services needed to maintain operational readiness.	+5,000
Total, Los Alamos National Laboratory	**+5,000**
Oak Ridge National Laboratory	
▪ **Iridium Fabrication Facilities for Radioisotope Power Systems** The increase from $4,410,000 to $4,660,000 is a minor increase in the cost of personnel required to maintain capability at the iridium fabrication facilities.	+250
▪ **Capital Equipment for Iridium Fabrication Facilities** The decrease from $750,000 to $500,000 is due to reduced capital equipment needs in FY 2011.	-250
Total, Oak Ridge National Laboratory	**+0**
Total, Space and Defense Infrastructure	**+5,000**

Capital Operating Expenses and Construction Summary
Capital Operating Expenses

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Capital Equipment	4,000	3,250	3,000
Total, Capital Operating Expenses	4,000	3,250	3,000

Research Reactor Infrastructure

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Research Reactor Infrastructure			
Idaho National Laboratory	6,146	10,000	4,818
Total, Research Reactor Infrastructure	6,146	10,000	4,818

Benefits

This program provides fresh reactor fuel to and removes used fuel from 26 operating university reactors. It supports the continued operation of university research reactors by providing test reactor capability to universities, coupled with research, development, and educational opportunities in support of U.S. nuclear energy initiatives.

This program supports the continued operation of university research reactors which play an important role in developing future scientists and engineers in the United States. This program sustains unique capabilities for research and development and educational opportunities supporting U.S. energy initiatives. Used fuel shipments support U.S. and Department of Energy non-proliferation and national security objectives.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Idaho National Laboratory FY 2011 funds would provide universities with fresh fuel to support continued operation of their research reactors and the shipments of used fuel as needed. Funding also supports maintenance and repair of fuel fabricating equipment.	**6,146**	**10,000**	**4,818**
Total, Research Reactor Infrastructure	**6,146**	**10,000**	**4,818**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Idaho National Laboratory The decrease from $10,000,000 to $4,818,000 is attributed to the completion of the following activities: 1) fabrication of a spare fuel inventory to respond to unplanned U.S. university fuel needs, and 2) reactor equipment and instrumentation upgrades at U.S. universities.	-5,182
Total, Idaho National Laboratory	**-5,182**

Oak Ridge Nuclear Infrastructure

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Oak Ridge Nuclear Infrastructure			
Oak Ridge National Laboratory	12,500	10,000	0
Total, Oak Ridge Nuclear Infrastructure	12,500	10,000	0

Benefits

In FY 2010, this Congressionally directed funding will be used for hot cell upgrades and maintenance at the Radiochemical Engineering Development Center (REDC) at the Oak Ridge National Laboratory, which is the Department's production, storage, and distribution center for heavy-element research activities.

Constructed in the mid-1960's, REDC contains hot cells in Buildings 7920 and 7930 and auxiliary facilities that support laboratory scale testing in the areas of aqueous separation research and development and irradiated target processing activities for the High Flux Isotope Reactor.

Detail Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Oak Ridge National Laboratory	**12,500**	**10,000**	**0**

Based on FY 2010 Congressional direction, funding in the amount of $10,000,000 was provided for the following activities:

- Conduct corrective and other targeted maintenance on nuclear safety and facility support components and equipment within REDC building systems such as ventilation, electrical, instrumentation, air, steam, cooling water, hot cells windows, manipulators, building structure and hoists/cranes; and
- Perform roof refurbishment and off-gas upgrades to the high-efficiency particulate air systems.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Oak Ridge National Laboratory	
The decrease from $10,000,000 to $0 reflects the elimination of this Congressionally directed funding. No funding is requested in FY 2011 for these activities.	**-10,000**
Total Funding Change, Oak Ridge National Laboratory	**-10,000**

Los Alamos Nuclear Infrastructure

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Los Alamos Nuclear Infrastructure			
Los Alamos National Laboratory	12,500	10,000	0
Total, Los Alamos Nuclear Infrastructure	12,500	10,000	0

Benefits

In FY 2010, this Congressionally directed funding was used to support equipment and facility upgrades, maintenance, and management practices at Los Alamos National Laboratory (LANL).

The LANL radiological facilities provide unique national actinide capabilities in the areas of analytical chemistry, materials characterization, chemical diagnostics, radiochemistry, and applied spectroscopy.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Los Alamos National Laboratory	**12,500**	**10,000**	**0**

Based on FY 2010 Congressional direction, funding in the amount of $10,000,000 was applied to the following activities:

- Address deficiencies in building structures, systems and components that are credited to the facilities' operations and safety bases;
- Perform maintenance and end-of-life replacement of equipment and infrastructure to assure that the facilities continue to meet Departmental safety standards and required operational reliability;
- Maintain facility management practices to meet current Departmental requirements, including preparing safety documentation and supporting technical safety analyses, managing nuclear material inventories, enhancing worker protection programs, and training staff; and
- Conduct corrective and routine preventive maintenance on nuclear safety and facility support components and equipment within building systems.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Los Alamos National Laboratory The decrease from $10,000 to $0 reflects the elimination of this Congressionally directed funding. No funding is requested in FY 2011.	**-10,000**
Total Funding Change, Los Alamos National Laboratory	**-10,000**

Pu-238 Production Restart Project

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Pu-238 Production Restart Project			
Pu-238 Production Project	0	0	15,000
Total, Pu-238 Production Restart Project	0	0	15,000

Benefits

This Plutonium-238 (Pu-238) Production Restart Project will re-establish a domestic capability to produce Pu-238 for use in radioisotope power systems (RPS) and radioisotope heater units required by certain National Aeronautics and Space Administration (NASA) space missions and national security applications. The Department of Energy (DOE) will conduct the project in accordance with the principles of DOE Order 413.3A, the Department's approved project management system for acquisition of capital assets. The project will establish the capability to fabricate neptunium-237 (Np) targets, to irradiate the targets in existing DOE nuclear reactors, and to recover Pu-238 from the irradiated targets. The Department has an ongoing program to produce RPSs that rely on Pu-238 as an energy source. The capabilities necessary for developing these systems are funded within the Office of Nuclear Energy's Space and Defense Infrastructure program.

Pu-238-based RPSs are needed for certain NASA and potential national security applications where other power sources, such as batteries, fuel cells, and solar technologies are not viable. In the past NASA has used Pu-238-based RPSs to power missions to the outer planets Jupiter and Saturn, which are too distant from the Sun to depend on solar arrays to power their instruments. Likewise, Pu-238-fueled RPSs are critical to Mars missions, such as the Viking landers of the 1970s and the Mars Science Laboratory to be launched in 2011; solar panels cannot operate reliably on the planet given its frequent dust storms and temperature extremes. NASA also has depended on Pu-238 to fuel heater units to keep critical systems warm on spacecraft sent to Mars and destinations throughout the solar system. Continued access to Pu-238 will enable the agency to explore a wide range of planets, moons and asteroids.

Existing supplies of Pu-238 are limited. While NASA has been able to support planned missions with Pu-238 procured from Russia, that source is limited. National security applications are prohibited by agreement from using Russian-supplied Pu-238, and the remaining supply of domestically produced Pu-238, produced more than a decade ago, is dwindling. Additional Pu-238 will be needed within the next decade to meet NASA projected demand, as well as support longer term NASA needs and potential national security applications. NASA has established Pu-238 requirements to meet the power and heating needs of planned missions to explore the outer planets and a range of other solar system destinations for the next two decades. While the agency will continue to refine the needs of specific missions, particularly those anticipated in the more distant outyears, its requirement for Pu-238 is expected to remain constant. National security users' longer-term requirements are less certain.

Supply and demand analyses indicate that projected user needs can be met with a production rate of up to five kilograms of Pu-238 per year. DOE can provide the capability to support this production rate by modifying existing facilities, possibly in combination with minimal new construction. Initiating this project in FY 2011 is necessary because it is expected to take approximately eight years to reach full production capacity. Funds in FY 2011 will be used to update environmental analyses to support necessary National Energy Policy Act (NEPA) actions, complete conceptual design and initiate target production and separations development. The Department and NASA are working together to develop a start up plan, which will soon be submitted to Congress to address a reporting requirement in the Conference Report to Accompany H.R. 3183, Energy and Water Development and Related Agencies Appropriations Act, 2010, Report 111-278. That report will provide additional details on planned activities.

Cost-Share with NASA

As the primary user of Pu-238, NASA will share with DOE, in equal amounts, the capital cost of re-establishing a production capability. The full amount required for this project in FY 2011 is $30 million. The DOE request for $15 million complements a parallel NASA request for $15 million, which NASA will provide to DOE, to accomplish the full scope of activities. DOE and NASA will be submitting a start-up plan outlining how the project will be executed and how costs will be shared. This funding allocation reflects that Pu-238 production re-start is needed to support future requirements at user agencies, not because of a mission need within DOE.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Pu-238 Production Restart Project			
▪ **Pu-238/Conceptual Design and NEPA Support** Update environmental analyses to support necessary NEPA actions. Complete conceptual design of Np target production and irradiated target processing facilities, including project management and technical support in support of Critical Decision-1[a], Approve Alternative Selection and Cost Range, which is expected by December 2012. This request assumes an additional $10,250k from NASA will be provided to accomplish the full scope of this activity.	**0**	**0**	**10,250**
▪ **Pu-238/Target Production and Separations Development and Reactor Optimization** Finalize target design and fabrication using existing laboratory facilities and equipment. Initiate separations process development. Evaluate Advanced Test Reactor (ATR) and High Flux Isotope Reactor (HFIR) internal core configurations for optimal neutronics to produce Pu-238. Prepare documentation for developmental and full production target irradiation in ATR and HFIR. This request assumes an additional $4,750k from NASA will be provided to accomplish the full scope of this activity.	**0**	**0**	**4,750**
Total, Pu-238 Production Restart Project	**0**	**0**	**15,000**

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[a] Critical Decision-1 is the stage in the DOE's project management framework that reaffirms the mission need for a proposed project, establishes the alternative selections and forms the basis to proceed with the preliminary design. It also establishes the preliminary cost estimate and schedule ranges for the project.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Pu-238 Production Restart Project	
Pu-238/Conceptual Design and NEPA Support	
▪ The increase from $0 to $10,250,000 is due to the planned initiation of conceptual design and NEPA support activities.	**+10,250**
Pu-238/Target Production and Separations Development and Reactor Optimization	
▪ The increase from $0 to $4,750,000 is due to initiation of reactor optimization studies and process development activities.	**+4,750**
Total, Pu-238 Production Restart Project	**+15,000**

Idaho Facilities Management

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Idaho Facilities Management	140,000	0	173,000	162,482

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriations Act (2009)
P.L. 111-85, Appropriations Act (2010)

Mission

The mission of the Idaho Facilities Management (IFM) program is to manage the planning, acquisition, operation, maintenance, and disposition of nuclear facilities and resources at the Idaho National Laboratory (INL). The IFM program maintains Department of Energy (DOE) mission-supporting facilities and resources at INL in a safe, compliant status to support the Department's nuclear energy research, testing of naval reactor fuels and reactor core components, and range of national security technology programs that support the National Nuclear Security Administration (NNSA) and other Federal agencies such as the Department of Homeland Security in the areas of critical infrastructure protection and nuclear nonproliferation.

Benefits

The IFM program enables long-term nuclear research and development (R&D) activities by providing the people, facilities, equipment, and nuclear materials necessary to conduct a wide array of experimental activities in a safe and compliant manner. The Advanced Test Reactor (ATR) provides unique irradiation capability to further nuclear fuel and reactor component research in support of advanced nuclear reactor designs activities. The Materials and Fuels Complex (MFC) contains a comprehensive range of pre- and post-irradiation examinations to assess material and fuel characteristics and performance in varying reactor environments.

Through the National Scientific User Facility (NSUF), universities are able to access INL facilities and equipment to further nuclear science and engineering research goals.

Annual Performance Results and Targets

The IFM program contributes to the Secretary's Goal of *Energy: Build a Competitive, Low-Carbon Economy and Secure America's Energy Future* and to the National Nuclear Infrastructure GPRA Unit Program Goal. The program's performance measures contribute to these goals by ensuring that the Department's unique facilities, required for advanced nuclear energy technology R&D, are maintained and operated such that they are available to support national priorities. Key activities conducted under this program include ensuring that all Nuclear Energy (NE) facilities meet essential safety and environmental requirements and are maintained at user-ready levels. Other key activities include managing all special nuclear materials contained in these facilities and the disposition of DOE materials under NE ownership and providing support for university research reactors through fuel management and upgrading control system. The IFM program maintains DOE mission-supporting facilities and resources at INL in a user-ready status to support multiple nuclear energy R&D programs.

Annual Performance Targets and Results

Secretarial Goal: Energy

GPRA Unit Program Goal: National Nuclear Infrastructure

<table>
<tr><th>FY PY-3</th><th>FY PY-2</th><th>FY PY-1</th><th>FY PY</th><th>FY CY</th><th>FY BY</th><th>FY BY+1</th><th>FY BY+2</th><th>FY BY+3</th><th>FY BY+4</th></tr>
<tr><th>FY 2006</th><th>FY 2007</th><th>FY 2008</th><th>FY 2009</th><th>FY 2010</th><th>FY 2011</th><th>FY 2012</th><th>FY 2013</th><th>FY 2014</th><th>FY 2015</th></tr>
<tr><td colspan="10">Facility Availability Performance Measure: To ensure unique nuclear facilities are available to support critical Departmental missions, maintain a facility operability index of 0.9 for key IFM and program facilities. [Measures Under Development. Measures for this program will be finalized and in place by the start of FY 2011.]
FY 2010: Enable nuclear research and development activities by providing operational facilities and capabilities, as measured by availability percentages.
FY 2009 – FY 2006: To ensure unique nuclear facilities are available to support critical Departmental missions, maintain a facility operability index of 0.9 for key IFM and program facilities.</td></tr>
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<tr><td colspan="10">Cost and Schedule Performance Measure: Achieve cumulative variance of less than 10 percent from cost and schedule baselines at INL for IFM facilities and activities consistent with safe operations. [Measures Under Development. Measures for this program will be finalized and in place by the start of FY 2011.]
FY 2010: Execute general plant and construction projects within approved cost profiles and schedules, as measured by the total percentages of projects with cost performance indexes and schedule performance indexes between 0.9 and 1.15 (using earned value measurement systems for GPPs and other program defined maintenance and upgrade projects).
FY 2009 – FY 2006: Achieve cumulative variance of less than 10 percent from cost and schedule baselines at INL for IFM facilities and activities consistent with safe operations.</td></tr>
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<tr><td colspan="10">Deferred Maintenance Performance Measure: [New Measures Under Development. New measures for this program will be finalized and in place by the start of FY 2011.]</td></tr>
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Means and Strategies

The program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:
- Aggressively implement contracting reforms, including fixed price competitive bidding, earned value management, capital planning processes in accordance with DOE Order 413.3A, independent external evaluations, etc., to ensure that the infrastructure program is operating effectively and efficiently to meet the Department's highest priority program needs.
- Ensure that mission essential systems, resources, and services are identified, maintained, and operated in compliance with DOE, Federal, and state safety and environmental requirements in a secure and cost-effective manner.

The Department will implement the following strategies:
- Identify IFM mission critical facilities and activities through various means, including review of the INL Ten-Year Site Plan and other relevant materials. Develop detailed work planning and funding requests accordingly.
- Meet periodically throughout the year with INL, NRC, NNSA and the Test, Research, and Training Reactor Management Group to review university research reactor activities; discuss program issues; and solicit input, advice, and guidance.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:
- Changes in nuclear energy R&D progress and priorities could possibly impact priorities within the IFM program, but not necessarily impact its overall cost and long-term liabilities.

In carrying out the program's mission, the program performs the following collaborative activities:
- As a NSUF, INL carries out a variety of experiment design, fabrication, irradiation, and post-irradiation work in support of the NNSA, Naval Reactors, universities, and industry organizations.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs. Examples of NE's R&D programs include Reactor Concepts Research, Development and Demonstration and Fuel Cycle R&D. NE infrastructure programs, such as the Radiological Facilities Management program and the IFM program, are managed using similar oversight techniques.

NE engages its stakeholders to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. NE's programmatic activities are also subject to periodic external reviews by Congress, GAO, the

Department's IG, NRC, the EPA, state environmental and health agencies, and the Department's Office of Engineering and Construction Management. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences.

Idaho Facilities Management

Funding Schedule by Activity

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Idaho Facilities Management			
INL Nuclear Research Reactor Operations and Maintenance	50,717	58,537	58,537
INL Non-Reactor Nuclear Research Facility Operations and Maintenance	41,238	53,825	51,506
INL Engineering and Support Facility Operations and Maintenance	14,369	20,741	14,005
National Scientific User Facility	3,559	4,000	4,000
INL Regulatory Compliance	10,467	7,388	12,183
INL Facility Infrastructure Revitalization Program	17,200	28,509	22,251
Radiological and Environmental Sciences Laboratory	2,450	0	0
Total, Idaho Facilities Management	140,000	173,000	162,482

Benefits

The IFM program enables long-term nuclear R&D activities by providing the people, facilities, equipment, and nuclear materials necessary to conduct a wide array of experimental activities. The ATR provides unique irradiation capability to further nuclear fuel and reactor component research in support of advanced nuclear reactor designs activities. The MFC contains a comprehensive range of pre- and post-irradiation examinations to assess material and fuel characteristics and performance in varying reactor environments. The Research and Education Campus houses laboratories, machining and glass shops, and administration building that support R&D for multiple programs.

Through the NSUF, universities are able to access INL facilities and equipment to further nuclear science and engineering research goals.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
INL Nuclear Research Reactor Operations and Maintenance	**50,717**	**58,537**	**58,537**

This category supports nuclear research reactor operations and maintenance at the INL for the ATR and associated supporting infrastructure, the ATR Critical Facility (ATRC), and the Neutron Radiography Reactor (NRAD). It also maintains the Transient Reactor Test (TREAT) facility in an inactive standby mode.

The primary reactor at INL is the ATR. ATR supports the majority of NE R&D programs as well as NNSA programs, including Naval Reactors Program work in support of the U.S. Navy nuclear fleet and Global Threat Reduction Initiatives to support conversion of research and test reactors to low-enriched uranium fuel. The ATR also supports universities and industry users. Programmatic work is funded by the sponsoring programs. The cost to other users depends upon the demands on the reactor and the nature of the user in accordance with DOE regulations.

In FY 2010, key planned accomplishments include: conduct the analysis and down selection process for upgrading safety related ATR nuclear instrumentation; complete modifications for ATR Loop 2A, complete six spent ATR fuel shipments to the Idaho Nuclear Technology and Engineering Center; complete more than 35 irradiation campaigns for universities, the NNSA's Offices of Naval Reactors and Defense Nuclear Nonproliferation, and production of Cobalt-60 for commercial use in industrial radiography sources.

In FY 2011, the following reactor activities will be supported:

- ATR operations includes funding for five reactor crews; operations management; new fuel, core components and supplies; critical facility operations; test sponsor engineering and safety; reactor systems engineering; project management; safety basis maintenance; training; quality assurance; safety and environmental programs and oversight; and personnel, materials and services required to maintain all of the 54 buildings and structures, utilities, and grounds within the perimeter of the ATR site. The request also supports over 40 irradiation campaigns as scheduled while maintaining an operating efficiency greater than 80%, and operating ATR Loop 2A with enhanced instrumentation and fuel ramp capability to support advanced fuel and material testing experiments.
- Maintenance and repair of ATR and the surrounding complex includes the cost of personnel, materials and services required to maintain the buildings, equipment, structures, utilities, and grounds. ATR has extensive system surveillance and maintenance requirements that are dictated by component manufacturers, Technical Specifications and Requirements and local procedures. The request also supports scheduled maintenance activities consistent with these established requirements.
- ATR life extension and safety margin improvement activities restore outdated systems and documentation essential to maintaining performance and reliability to extend operations at a small fraction of the reactor's replacement cost. Although over 40 years old, the ATR has the potential for an extremely long operating life due to its unique design that allows extensive replacement of neutron-damaged components on an approximately seven year cycle. The request also supports activities such as ATR safety related nuclear-power-indicating instrumentation replacement and engineering and system analysis trade-off studies for ATR systems.
- NRAD, ATRC, and TREAT reactors operations and maintenance activities including preventative and corrective maintenance on reactor systems, maintaining safety basis documentation, and training and qualification activities for reactor operators. The request also supports planned operational and maintenance levels for NRAD and ATRC, consistent with scheduled experiments as well as continued surveillance and the preservation of essential systems for the TREAT reactor.

	FY 2009	FY 2010	FY 2011
INL Non-Reactor Nuclear Research Facility Operations and Maintenance	**41,238**	**53,825**	**51,506**

This category funds operations, maintenance, and support for non-reactor nuclear and radiological research facilities. The non-reactor nuclear research facilities support programmatic activities such as nuclear fuel development, separations development, pre- and post-irradiation fuel examinations, and

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

radiological chemical analysis. This category also funds the management of NE-owned special nuclear materials (SNM), including the characterization, packaging, and disposition of surplus SNM.

In FY 2010, key planned accomplishments include: completion of documented safety analyses (DSA) upgrades for key MFC nuclear facilities such as the Zero Power Physics Reactor building and the Analytical Laboratory to comply with Departmental requirements, completion of the required DSA-identified facility upgrades to the Fuel Conditioning Facility and Hot Fuel Examination Facility (HFEF), and completion of approximately two to three off-site shipments of surplus SNM.

In FY 2011, the following activities will be supported:

- Provide trained operators and technicians; provide qualified criticality safety officers and material balance custodians; prioritize and support maintenance and modification activities; analyze and authorize adjustments to operating parameters and facility operations; coordinate programmatic work activities; conduct and participate in audits, assessments, and reviews; develop and coordinate action plans; develop and provide nuclear training, quality assurance, document management; systems and safety engineering; environment, safety and health; nuclear materials management and stewardship; and program integration to support effective execution of projects and programs within the nuclear facilities at the MFC.
- Nuclear maintenance and repair includes the cost of personnel, materials, and services required to maintain the buildings, equipment, structures, utilities, and grounds within the perimeter fence at the MFC site and other radiological facilities. This includes facility safety system and procedural upgrades as identified through revised DSAs conducted in FY 2010. Examples of these upgrades may include, but not be limited to, control system upgrades, heating, ventilating, and air conditioning modifications, seismic structural improvements, and operations and maintenance procedure improvements.
- SNM management activities for NE-owned programmatic and surplus SNM at INL, including characterization, stabilization, and disposal of surplus SNM. The request supports the maintenance and operation of glove boxes and supporting systems to condition and prepare NE-owned surplus plutonium and uranium for off-site disposition.

	FY 2009	FY 2010	FY 2011
INL Engineering and Support Facility Operations and Maintenance	**14,369**	**20,741**	**14,005**

This category funds all activities that support the effective management of the buildings, structures and systems that support the non-nuclear facilities at the INL consistent with Departmental orders and regulations.

In FY 2010 key planned accomplishments include: completing scheduled facility inspections to assess structural, roof, and systems conditions and preparing three to five surplus, non-radiological facilities for disposition.

The FY 2011, the following activities will be supported:

- Real property life-cycle asset management.
- Recapitalization activities structured to keep existing facilities modern and relevant in an environment of changing standards and missions, consistent with DOE Order 430.1B requirements.

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011

- Life-cycle planning to identify essential capital alterations and additions; improvements to land, buildings, and utility systems necessary to maintain INL general purpose infrastructure; common/domestic services infrastructure; and multi-program infrastructure.
- Alternative analyses for accomplishing NE-sponsored activities.
- Continue implementation of a systematic real property asset building inspection program and operation and maintenance of the Department's Facility Information Management System and Condition Assessment Information System.

Additionally, support is provided for Federally-funded program activities and community regulatory support activities to meet obligations defined in crosscutting agreements and contracts such as: S.M. Stoller, Payment in Lieu of Taxes, Shoshone-Bannock Tribes, and the National Oceanic and Atmospheric Administration. Beginning in FY 2011, funding in the amount of $1,700,000 to support background investigations conducted by the Federal Bureau of Investigation and the OPM is included in the Idaho Sitewide Safeguards and Security program request.

National Scientific User Facility	**3,559**	**4,000**	**4,000**

This category promotes the use of INL nuclear facilities for non-traditional science-based experiments to encourage active university, industry, and laboratory collaboration in relevant nuclear scientific research. The NSUF provides a mechanism for partner organization to propose and conduct experiments that introduce new techniques, equipment, and personnel in order keep INL capabilities current with new technologies. This work assures continuous improvements in experimental capabilities at the ATR. Last year, university experimenters have proposed and are developing computer-aided experiment design tools, ways to more efficiently extract data from irradiated samples and advanced instrumentation to measure neutron levels in the core.

In FY 2010 key planned accomplishments include: award three to five university experiments using the ATR and other INL research facilities; conduct the annual NSUF User Week workshops to bring together over 100 researchers representing academia, industry and national laboratories to foster collaboration on nuclear energy issues; and support six university partnerships to increase available capabilities for NSUF experiments.

In FY 2011, the following activities will be supported:

- Maintaining support for 6 university partnerships;
- Awarding up to 5 university experiments using ATR and other INL research facilities and multiple smaller-scale experiments using previously irradiated samples at partnership locations; and
- Conducting NSUF user's week at the INL to educate new users of INL research facilities.

INL Regulatory Compliance	**10,467**	**7,388**	**12,183**

This category supports compliance activities driven by State and Federal environmental and other regulations that are under the purview of NE owner responsibilities. This category also supports other project costs for the proposed Remote-Handled Low Level Waste (RHLLW) Disposal Project to meet long-term waste disposal needs for NE and Office of Naval Reactors, consistent with regulatory requirements.

In FY 2010, key planned accomplishments include: treatment of two cubic meters of sodium-contaminated low-level waste backlog at MFC; obtain Critical Decision 1 (Approve Alternative Selection and Cost Range) for the RHLLW Disposal Project; and complete closure of the Resource Conservation and Recovery Act Voluntary Consent Order commitments at ATR.

In FY 2011, the request supports: processing of approximately 400 kilograms of Experimental Breeder Reactor (EBR)-II sodium-bonded fuel, consistent with the 1995 Settlement Agreement; treatment of approximately two cubic meters of sodium-contaminated low-level waste backlog; and develop documentation to support Critical Decision 2 (Approve Performance Baseline) for the RHLLW Disposal Project.

INL Facility Infrastructure Revitalization Program 17,200 28,509 22,251

This category restores, rebuilds, and revitalizes the physical INL infrastructure by replacing aging facilities and larger equipment to address costly, beyond useful life maintenance. These activities enhance program execution, satisfy a critical need for improvement to INL infrastructure, and make a significant contribution to the overall reduction of complex-wide deferred maintenance by providing capabilities that improve safety, reliability and energy efficiency and meet current and future program research needs. The INL Facility Infrastructure Revitalization Program consists of operational-funded projects, General Plan Project (GPP) and General Purpose Capital Equipment (GPCE) and associated pre-planning requirements. Activities performed are consistent with INL five-year infrastructure plans; however, these activities have a level of uncertainty due to the unpredictable nature of infrastructure failures and changing site priorities throughout the year.

In FY 2010, key planned accomplishments include: completing scheduled operational-funded projects and GPPs, including the ATR Radioanalytical Chemistry Laboratory, MFC Dial Room Replacement, and HFEF Argon Chiller System; initiating multiple revitalization projects at ATR and MFC to reduce deferred maintenance; and purchasing priority equipment, including the analytical laboratory remote manipulator; a 25-ton lift truck; and a heat exchanger replacement at ATR.

In FY 2011, the following planned activities include: initiation of new operational-funded projects, GPP projects, and GPCE purchases including, but not limited to:

- Site-wide facility revitalization activities ATR, MFC, and REC to reduce maintenance backlogs and improve infrastructure and reliability of capabilities.
- Replacement of facilities and/or capabilities such as the MFC Analytical Laboratory Alpha and Sodium Gloveboxes to replace 40+ year gloveboxes with modern, compartmentalized, multi-functional gloveboxes to support inert and air atmospheric post-irradiation examination work.
- Equipment purchases such as uninterrupted power supplies to support dial room communication hub in the Central Facilities Area.

Radiological and Environmental Sciences Laboratory 2,450 0 0

Funding for the Radiological and Environmental Sciences Laboratory, a government-owned, government-operated laboratory, was moved to NE's Program Direction Account starting in FY 2010, consistent with federally staffed facilities funding practices.

Total, Idaho Facilities Management 140,000 173,000 162,482

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Idaho Facilities Management	
▪ **INL Non-Reactor Nuclear Research Facility Operations and Maintenance** The decrease from $53,825,000 to $51,506,000 reflects the completion the purchase and installation of glove boxes to prepare surplus special nuclear material for off-site shipment.	-2,319
▪ **INL Engineering and Support Facility Operations and Maintenance** The decrease from $20,741,000 to $14,005,000 reflects the completion of one-time planning and preparation activities to disposition surplus non-radiological facilities and a reduction for personnel security investigation activities that are now funded under the Idaho Sitewide Safeguards and Security program.	-6,736
▪ **INL Regulatory Compliance** The increase from $7,388,000 to $12,183,000 reflects moving the processing of EBR-II spent nuclear fuel for off-site shipment from the Fuel Cycle R&D program to IFM in FY 2011 and other project costs for the RHLLW Disposal Project.	+4,795
▪ **Idaho Facility Infrastructure Revitalization Program** The decrease from $28,509,000 to $22,251,000 reflects a level of execution for new operational-funded projects that is consistent with other IFM priorities and the completion of a one-time purchase of an Atom Probe to enhance multi-program experimental capabilities.	-6,258
Total Funding Change, Idaho Facilities Management	**-10,518**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
General Plant Projects	14,363	15,884	7,082
Capital Equipment	500	3,377	2,600
Total, Capital Operating Expenses	14,863	19,261	9,682

Major Items of Equipment *(TEC $2 million or greater)*

(dollars in thousands)

	Total Project Cost (TPC)	Total Estimated Cost (TEC)	Prior-Year Appro-priations	FY 2009	FY 2010	FY 2011	Completion Date
Atom Probe	2,200	2,075	0	0	2,200	0	FY 2010
Total, Major Items of Equipment				0	2,200	0	

Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2009	FY 2010	FY 2011
Idaho Operations Office			
Salaries and Benefits	25,565	24,890	25,886
Travel	996	996	1,016
Support Services	1,004	1,015	1,035
Other Related Expenses	5,111	5,036	5,512
Total, Idaho Operations Office	32,676	31,937	33,449
Full Time Equivalents	197	197	197
Radiological and Environmental Sciences Laboratory			
Salaries and Benefits	2,440	2,440	2,538
Travel	65	65	66
Support Services	0	258	263
Other Related Expenses	394	2,400	2,631
Total, Radiological and Environmental Sciences Laboratory	2,899	5,163	5,498
Full Time Equivalents	19	19	19
Oak Ridge Operations Office			
Salaries and Benefits	955	1,000	1,060
Travel	20	20	20
Support Services	50	51	252
Other Related Expenses	265	282	288
Total, Oak Ridge Operations Office	1,290	1,353	1,620
Full Time Equivalents	8	8	8
Headquarters			
Salaries and Benefits	24,314	23,618	37,222
Travel	1,200	1,200	1,624
Support Services	3,971	4,052	4,768
Other Related Expenses	6,650	5,677	7,271
Total, Headquarters	36,135	34,547	50,885
Full Time Equivalents	171	160	200

	FY 2009	FY 2010	FY 2011
	(dollars in thousands/whole FTEs)		
Total Program Direction			
Salaries and Benefits	53,274	51,948	66,706
Travel	2,281	2,281	2,726
Support Services	5,025	5,376	6,318
Other Related Expenses	12,420	13,395	15,702
Total, Program Direction	73,000	73,000	91,452
Total, Full Time Equivalents	395	384	424

Mission

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Office of Nuclear Energy (NE).

In addition to appropriated funds, NE also manages approximately $70 million dollars annually in work for others and reimbursable funding from the National Aeronautics and Space Administration and the Department of Defense for the development of advanced radioisotope power systems for space exploration and national security missions.

Detailed Justification

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Salaries and Benefits	**53,274**	**51,948**	**66,706**

This account provides funding to support the salaries and benefits of the personnel associated with NE programs. Currently, 25 percent of the workforce is eligible to retire and an additional five percent will be eligible by the end of FY 2011. Over the past several years, NE has been trying to address the issue of an aging workforce through the recruitment of entry-level engineering, scientific, and administrative positions. In FY 2011, NE plans to hire additional staff to fulfill its current Full Time Employee (FTE) allocation of 424. In addition to the Headquarters staff (197), NE funds field employees at the Idaho Operation Office (197), the Radiological and Environmental Sciences Laboratory in Idaho (19), the Oak Ridge Operations Office (8), and three employees who support the U.S. Mission to the Organization for Economic Cooperation and Development in Paris (1); U.S. Mission to International Organizations in Vienna (1); and the Department of Energy Tokyo Office (1). The request includes funds for additional FTEs to oversee ongoing responsibilities under the Nuclear Waste Policy Act, including administration of the Nuclear Waste Fund and the Standard Contract.

Travel	**2,281**	**2,281**	**2,726**

Travel includes funding for transportation of Headquarters and Operations Office personnel associated with NE programs, their per diem allowances while in authorized travel status, and other expenses incidental to travel. Also included are travel funds to support the additional FTE's necessary to oversee ongoing responsibilities under the Nuclear Waste Policy Act.

	(dollars in thousands) FY 2009	FY 2010	FY 2011
Support Services	**5,025**	**5,376**	**6,318**

Support services include funding for technical and management support services provided to NE Headquarters and the Operations Offices. The use of support services allows the Department to hire the best available industry experts to assist Federal staff in managing the nuclear programs and complex activities. In addition to rapidly acquiring this expertise, using support services provides unlimited flexibility in team composition as the needs of NE evolve.

	FY 2009	FY 2010	FY 2011
Other Related Expenses	**12,420**	**13,395**	**15,702**

The major expenditure in the Other Related Expenses category in FY 2011 is $3,641,000 for the Headquarters Working Capital Fund (WCF). The WCF provides funding for mandatory administrative costs, such as: building occupancy and telephone services; copying, printing, and graphics; networking and desktop support; procurement management; payroll and personnel; corporate training services; and the project management career development program. Beginning in FY 2011, this account also includes WCF to support the additional FTEs to oversee ongoing responsibilities under the Nuclear Waste Policy Act. The Other Related Expense category also includes support for NE's Federal advisory committee and training, as well as, the housing, office communications, supplies, miscellaneous expenses, and International Cooperative Administrative Support Services expenses associated with the three employees assigned overseas.

	FY 2009	FY 2010	FY 2011
Total, Program Direction	**73,000**	**73,000**	**91,452**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits The increase from $51,948,000 to $66,706,000 reflects the following: allowed escalation and additional funds for promotions, awards, and within-grade salary increases (+$2,799,000); additional staff at HQ to support new programs (+$2,700,000); and additional FTEs to oversee ongoing responsibilities under the Nuclear Waste Policy Act. (+$9,259,000).	+14,758
Travel The increase from $2,281,000 to $2,726,000 reflects additional funds for projected travel requirements in FY 2011 including $200,000 to oversee ongoing responsibilities under the Nuclear Waste Policy Act.	+445

	FY 2011 vs. FY 2010 ($000)
Support Services The increase from $5,376,000 to $6,318,000 is primarily due to an increase in support services required at Headquarters (HQ) for NE programs (+$716,000), additional support required at Oak Ridge for Uranium Fuel Supply activities (+$201,000), and a minor increase at Idaho (+$25,000).	+942
Other Related Expenses The increase from $13,395,000 to $15,702,000 is primarily due to an increase in requirements to support the WCF including the expenses associated with additional FTEs oversee ongoing responsibilities under the Nuclear Waste Policy Act. Also included are increases for rent and utilities, maintenance of equipment, and other services at the Idaho Operations Office.	+2,307
Total Funding Change, Program Direction	**+18,452**

Support Services by Category

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Technical Support			
Feasibility of Design Considerations	932	950	1,214
Development of Specifications	390	425	445
Economic and Environmental Analyses	300	345	407
Surveys Or Reviews of Technical Operations	528	590	650
Total, Technical Support	2,150	2,310	2,716
Management Support			
Automated Data Processing	1,400	1,500	1,700
Manpower Systems Analyses	200	220	335
Preparation of Program Plans	150	160	225
Training and Education	125	135	156
Reports and Analyses Management and General Administrative Services	1,000	1,051	1,186
Total, Management Support	2,875	3,066	3,602
Total, Support Services	5,025	5,376	6,318

Other Related Expenses by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Working Capital Fund	4,074	3,439	3,641
Advisory and Assistance Services	100	100	153
Operations and Maintenance of Equipment	2,212	2,517	2,735
Printing and Reproduction	53	54	56
Training	374	377	394
Rent and Utilities	10	64	65
Communications, Utilities, Misc.	1,261	1,230	1,331
Supplies and Materials	636	1,043	1,075
Other Services	3,700	4,571	6,252
Total, Other Related Expenses	12,420	13,395	15,702

International Nuclear Energy Cooperation

Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
International Nuclear Energy Cooperation	0	0	0	3,000

Mission

The objective of International Nuclear Energy Cooperation (INEC) is to support the Office of Nuclear Energy (NE) program offices in implementing international cooperative research and development (R&D) activities that further NE's mission; provide technical, policy, and administrative support to carry out the civilian nuclear energy aspects of officially approved international agreements and other relevant U.S. international commitments; provide advice and support to other Department of Energy (DOE) offices and Federal agencies that are planning and/or implementing new agreements and other U.S. commitments having civilian nuclear energy aspects; and serve as advisors to other DOE offices and Federal agencies on general issues related to the international use of civilian nuclear energy.

Benefits

The requested funding would support INEC in its role as NE's principal program supporting NE's international civil nuclear energy activities. INEC will work with NE's R&D programs on the development, negotiation, and execution of international bilateral and multilateral agreements; the provision of policy analysis and guidance on U.S. international civil nuclear activities; support for international nuclear energy cooperation and monitoring of technical, political, and business activities associated with export of U.S. nuclear energy goods and services. INEC serves as the central coordinating program for international engagement within NE and represents NE, along with relevant R&D program staff, in interactions with other government agencies including the Department of State, National Security Council, Department of Commerce, and the NRC.

The requested funding would support international discussion and negotiations and related analyses on a range of international nuclear energy concerns. It would also work with international partners on developing the new framework for civil nuclear cooperation that President Obama called for in his April 2009 speech in Prague: "And we should build a new framework for civil nuclear cooperation… so that countries can access peaceful power without increasing the risks of proliferation. That must be the right of every nation that renounces nuclear weapons, especially developing countries embarking on peaceful programs.".

Annual Performance Results and Targets

The International Nuclear Energy Cooperation program contributes to the Secretary's Goal of *Energy:*

Build a Competitive, Low-Carbon Economy and Secure America's Energy Future and to the New Nuclear Generation Technologies GPRA Unit Program Goal. The International Nuclear Energy Cooperation program supports NE program offices in implementing international cooperative R&D activities that further NE's mission. These activities include working with the R&D programs and providing technical, policy and administrative support to carry out the civilian nuclear energy aspects of officially approved international agreements and other relevant U.S. international commitments and assisting other DOE offices and Federal agencies on general issues related to the international use of civilian nuclear energy.

Means and Strategies

The program will use various means and strategies to achieve its GRPA Unit Program Goal. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

The Department will implement the following means:

- NE will provide technical expertise in support of international bilateral and multilateral engagement and civil nuclear energy R&D with countries that are established as significant participants in the nuclear sector

The Department will implement the following strategies:

- NE will partner with the private sector, national laboratories, universities and international partners to support cooperative international R&D activities to support the international use of civilian nuclear power.
- NE will work with DOE's Office of Policy and International Affairs as well as other U.S. Government organizations, including the National Nuclear Security Administration, National Security Council, and Department of State, to support the international use of civilian nuclear power.

These strategies will result in efficient and effective management of the program, thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the program's ability to achieve its strategic goal:

- The international use of civilian nuclear power depends on a number of economic, environmental, and national security factors beyond the scope of DOE's programs. The safe expansion of nuclear energy is contingent upon resolving key challenges associated with limiting proliferation risks associated with international nuclear power deployment.

Validation and Verification

NE conducts various internal and external reviews and audits to validate and verify program performance. Periodic program reviews evaluate progress against established plans. NE holds monthly, quarterly, semi-annual, and annual reviews, consistent with program management plans and project baselines, to ensure technical progress, cost, and schedule adherence, and responsiveness to program requirements. Internally, NE provides continual management and oversight of its R&D and vital infrastructure programs, including its international engagement activities. Examples of NE's R&D programs include Reactor Concepts Research, Development & Demonstration, and Fuel Cycle R&D.

NE infrastructure programs, such as the Radiological Facilities Management program and the Idaho Facilities Management program, are managed using similar oversight techniques.

NE has engaged its stakeholders to help define the appropriate scope of NE's program activities to support nuclear energy's role in meeting the Nation's energy security and environmental goals. In addition, NE solicits the advice and counsel of external agencies such as Nuclear Energy Advisory Committee and National Academy of Sciences. NE's international engagement activities are conducted in consultation and cooperation with a number of U.S. government organizations, including the National Nuclear Security Administration, National Security Council, and Department of State.

International Nuclear Energy Cooperation

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
International Nuclear Energy Cooperation	0	0	3,000

Benefits

The requested funding would support INEC in its role as NE's principal program for coordinating the analysis, development, and implementation of international civil nuclear energy policy. These activities include supporting international bilateral and multilateral engagement and civil nuclear energy R&D activities with countries that are established as significant participants in the civilian nuclear power sector. This program could also include the creation of workshops to engage industry and foreign governments.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
International Nuclear Energy Cooperation	**0**	**0**	**3,000**

In FY 2011, funding would support international civil nuclear energy technical coordination activities that would allow the Department to more efficiently pursue international R&D opportunities, including collaborating in key facilities and in the development of technologies unique to the foreign partners, as appropriate. This may include exploring international fuel service arrangements to build a new framework for civil nuclear cooperation, so that counties can access nuclear energy without increasing the risks of proliferation.

In addition, the funding supports U.S. participation in international organizations that engage in technical collaboration and influence global nuclear energy policy, such as the International Atomic Energy Agency and the international Global Nuclear Energy Partnership. It also supports technical collaborations through bilateral Action Plans, Working Groups, and the International Nuclear Energy Research Initiative. Activities carried out within this program will be closely coordinated with international R&D activities carried out within the R&D programs to avoid duplication (e.g., Generation IV International Forum). NE's international collaborations aim to resolve challenges arising from the global expansion of nuclear power and reinforce U.S. nonproliferation, security and safety policies.

Total, International Nuclear Energy Cooperation	**0**	**0**	**3,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
International Nuclear Energy Cooperation The increase from $0 to $3,000,000 is provided to establish a function within NE to ensure collaboration across NE programs on international issues.	+3,000
Total Funding Change, International Nuclear Energy Cooperation	**+3,000**

Congressionally Directed Projects
Funding Profile by Subprogram

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2009 Current Recovery Act Appropriation	FY 2010 Current Appropriation	FY 2011 Request
Congressionally Directed Projects	2,854	0	2,500	0

Public Law Authorizations:
P.L. 111-8, Omnibus Appropriation Act (2009)
P.L. 111-85, Appropriation Act (2010)

Description
The FY 2009 and FY 2010 Appropriation Acts included three congressionally directed projects within the Office of Nuclear Energy, one in FY 2009 and two in FY 2010. No funding is requested for these activities in FY 2011.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Congressionally Directed Projects			
▪ Technologies Ventures Corporation, New Mexico	**2,854**	**0**	**0**
▪ Nuclear Fabrication Consortium, Ohio	**0**	**2,000**	**0**
▪ McClellan Nuclear Radiation Center, California	**0**	**500**	**0**
Total, Congressionally Directed Projects	**2,854**	**2,500**	**0**

Technologies Ventures Corporation, New Mexico: Funding was congressionally directed in FY 2009 for Technologies Ventures Corporation to assist a group of nuclear energy technology entrepreneurs with the development of their business case and funding proposal to facilitate equity investment in those ventures.

No funding was requested in FY 2010 or is requested in FY 2011.

Nuclear Fabrication Consortium, Ohio: Funding was congressionally directed in FY 2010 for the Nuclear Fabrication Consortium to develop fabrication approaches and data related to welding, joining and non-destructive examination that support the U.S. nuclear manufacturing, fabrication, and construction industries.

No funding is requested for FY 2011.

McClellan Nuclear Radiation Center, California: Funding was congressionally directed in FY 2010 for McClellan Nuclear Radiation Center to purchase equipment upgrades needed to resume the processing of medical and research radioisotopes such as Iodine-125.

No funding is requested for FY 2011.

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Congressionally Directed Projects	
No funding requested	-2,500
Total, Congressionally Directed Projects	**-2,500**

Defense Nuclear Waste Disposal

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Defense Nuclear Waste Disposal

[For nuclear waste disposal activities to carry out the purposes of Public Law 97-425, as amended, including the acquisition of real property or facility construction or expansion, $98,400,000, to remain available until expended.] *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Explanation of Change

All Defense Nuclear Waste Disposal project funding has been eliminated due to the termination of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management.

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Recovery Act Current Appropriation	FY 2010 Request	FY 2010 House	FY 2010 Senate	FY 2011 Request
Defense Nuclear Waste Disposal						
Repository Program	143,000	0	98,400	98,400	98,400	0
Total, Defense Nuclear Waste Disposal	143,000	0	98,400	98,400	98,400	0

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2009 Current Appropriation	FY 2010 Recovery Act Current Appropriation	FY 2010 Request	FY 2010 House	FY 2010 Senate	FY 2011 Request
Nuclear Waste Disposal						
Repository Program	40,252	0	17,700	17,700	17,700	0
Transportation	2,100	0	0	0	0	0
Program Management & Integration	26,200	0	10,700	10,700	10,700	0
Program Direction	74,983	0	70,000	70,000	70,000	0
Congressionally Directed	1,855	0	0	0	0	0
Total, Nuclear Waste Disposal	145,390	0	98,400	98,400	98,400	0
Defense Nuclear Waste Disposal						
Repository Program	143,000	0	98,400	98,400	98,400	0
Total, Defense Nuclear Waste Disposal	143,000	0	98,400	98,400	98,400	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	288,390	0	196,800	196,800	196,800	0

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

The Defense Nuclear Waste Disposal appropriation was established by the Congress as part of the 1993 Energy and Water Development Appropriation (P.L. 102-377), in lieu of payment from the Department of Energy (DOE) into the Nuclear Waste Fund for activities related to the disposal of defense high-level waste from DOE's atomic energy defense activities. The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option and has decided to terminate the Office of Civilian Radioactive Waste Management. The Nation needs a different solution for nuclear waste disposal. As a result, in 2010, the Department will discontinue its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and establish a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. All funding for development of the Yucca Mountain facility and the Office of Civilian Radioactive Waste Management will be eliminated by the end of FY 2010. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. Ongoing responsibilities under the Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of Nuclear Energy, which will lead future waste management activities.

No funding from the Defense Nuclear Waste Disposal is being requested.

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
NNSA Service Center			
Program Direction	1,000	500	0
Total, NNSA Service Center	1,000	500	0
Oak Ridge National Laboratory			
Program Direction	0	500	0
Total, Oak Ridge National Laboratory	0	500	0
Sandia National Laboratory			
Repository Project	47,000	40,000	0
Total, Sandia National Laboratory	47,000	40,000	0
Washington Headquarters			
Program Direction	44,590	50,000	0
Program Management and Integration	11,700	4,500	0
Repository Project	14,855	10,200	0
Transportation System	1,000	0	0
Total, Washington Headquarters	72,145	64,700	0
Repository Project Office			
Program Direction	29,393	19,000	0
Program Management and Integration	14,500	6,200	0
Repository Project	123,252	65,900	0
Transportation	1,100	0	0
Total, Repository Project Office	168,245	91,100	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	288,390	196,800	0

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Sandia National Laboratory			
Repository Project	47,000	40,000	0
Total, Sandia National Laboratory	47,000	40,000	0
Repository Project Office			
Repository Project	96,000	58,400	0
Total, Repository Project Office	96,000	58,400	0
Total, Defense Nuclear Waste Disposal	143,000	98,400	0

Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
NNSA Service Center			
Program Direction	1,000	500	0
Total, NNSA Service Center	1,000	500	0
Oak Ridge National Laboratory			
Program Direction	0	500	0
Total, Oak Ridge National Laboratory	0	500	0
Washington Headquarters			
Program Direction	44,590	50,000	0
Program Management and Integration	11,700	4,500	0
Repository Project	14,855	10,200	0
Transportation Project	1,000	0	0
Total, Washington Headquarters	72,145	64,700	0
Repository Project Office			
Program Direction	29,393	19,000	0
Program Management and Integration	14,500	6,200	0
Repository Project	27,252	7,500	0
Transportation Project	1,100	0	0
Total, Repository Project Office	72,245	32,700	0
Total, Nuclear Waste Disposal	145,390	98,400	0

Nuclear Waste Disposal

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Nuclear Waste Disposal

[For nuclear waste disposal activities to carry out the purposes of the Nuclear Waste Policy Act of 1982, Public Law 97-425, as amended (the "NWPA"), $98,400,000, to remain available until expended, and to be derived from the Nuclear Waste Fund: *Provided*, That of the funds made available in this Act for nuclear waste disposal and defense nuclear waste disposal activities, 2.54 percent shall be provided to the Office of the Attorney General of the State of Nevada solely for expenditures, other than salaries and expenses of State employees, to conduct scientific oversight responsibilities and participate in licensing activities pursuant to the NWPA: *Provided further*, That notwithstanding the lack of a written agreement with the State of Nevada under section 117(c) of the NWPA, 0.51 percent shall be provided to Nye County, Nevada, for on-site oversight activities under section 117(d) of the NWPA: *Provided further*, That of the funds made available in this Act for nuclear waste disposal and defense nuclear waste disposal activities, 4.57 percent shall be provided to affected units of local government, as defined in the NWPA, to conduct appropriate activities and participate in licensing activities under Section 116(c) of the NWPA: *Provided further*, That of the amounts provided to affected units of local government, 7.5 percent of the funds provided for the affected units of local government shall be made available to affected units of local government in California with the balance made available to affected units of local government in Nevada for distribution as determined by the Nevada affected units of local government: *Provided further*, That of the funds made available in this Act for nuclear waste disposal and defense nuclear waste disposal activities, 0.25 percent shall be provided to the affected federally-recognized Indian tribes, as defined in the NWPA, solely for expenditures, other than salaries and expenses of tribal employees, to conduct appropriate activities and participate in licensing activities under section 118(b) of the NWPA: *Provided further*, That notwithstanding the provisions of chapters 65 and 75 of title 31, United States Code, the Department shall have no monitoring, auditing or other oversight rights or responsibilities over amounts provided to affected units of local government: *Provided further*, That the funds for the State of Nevada shall be made available solely to the Office of the Attorney General by direct payment and to units of local govem-Account Number: 019-20-5227 Nuclear Waste Disposal (APPROPRIATIONS) (Department of Energy - Energy Programs) Page: 1 Agency: Department of Energy Printed: 2:41 PM Friday, January 22 Bureau: Energy Programs For General Counsel Review by direct payment: *Provided further*, That 4.57 percent of the funds made available in this Act for nuclear waste disposal and defense nuclear waste disposal activities shall be provided to Nye County, Nevada, as payment equal to taxes under section 116(c)(3) of the NWPA: *Provided further*, That within 90 days of the completion of each Federal fiscal year, the Office of the Attorney General of the State of Nevada, each affected federally-recognized Indian tribe, and each of the affected units of local government shall provide certification to the Department of Energy that all funds expended from such payments have been expended for activities authorized by the NWPA and this Act: *Provided further*, That failure to provide such certification shall cause such entity to be prohibited from any further funding provided for similar activities: *Provided further*, That none of the funds herein appropriated may be: (1) used directly or indirectly to influence legislative action, except for normal and recognized executive-legislative communications, on any matter pending before Congress or a State legislature or for lobbying activity as provided in 18 U.S.C. 1913; (2) used for litigation expenses; or (3) used to support multi-State efforts or other coalition building activities inconsistent with the restrictions contained in this Act: *Provided further*, That all proceeds and recoveries realized by the Secretary in carrying out activities authorized by the NWPA, including but not limited to, any proceeds from the sale of assets, shall be available without further appropriation and shall remain available until expended: *Provided further*, That of the funds made available in this Act for Nuclear Waste Disposal, $5,000,000 shall be provided to create a Blue Ribbon Commission to consider all alternatives for nuclear waste disposal: *Provided further*, That no funds provided in this Act or any previous Act may be used to pursue repayment or collection of funds provided in any fiscal year to affected units of local government for oversight activities that had been previously approved by the Department of Energy, or to withhold payment of any such funds.] *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*

Explanation of Change

All Nuclear Waste Disposal project funding has been eliminated due to the termination of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management.

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Overview

Appropriation Summary by Program

	FY 2009 Current Appropriation	FY 2010 Current Recovery Act Appropriation	FY 2010 Request	FY 2011 Request
Nuclear Waste Disposal				
Repository Program	40,252	0	17,700	0
Transportation	2,100	0	0	0
Program Management & Integration	26,200	0	10,700	0
Program Direction	74,983	0	70,000	0
Congressionally Directed	1,855	0	0	0
Total, Nuclear Waste Disposal	145,390	0	98,400	0
Defense Nuclear Waste Disposal				
Repository Program	143,000	0	98,400	0
Total, Defense Nuclear Waste Disposal	143,000	0	98,400	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	288,390	0	196,800	0

Preface

The Nuclear Waste Disposal Account was established as part of the Nuclear Waste Policy Act of 1982 (P.L. 97-425), as amended, to provide funding to implement Federal policy for disposal of commercial spent nuclear fuel and high-level radioactive waste by the Office of Civilian Radioactive waste Management. The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option and has decided to terminate the Office of Civilian Radioactive Waste Management. The Nation needs a different solution for nuclear waste disposal. As a result, in 2010, the Department will discontinue its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and establish a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. All funding for development of the Yucca Mountain facility and the Office of Civilian Radioactive Waste Management will be eliminated by the end of FY 2010. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. Ongoing responsibilities under the Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of Nuclear Energy, which will lead future waste management activities.

Mission

The mission of OCRWM was to manage and dispose of spent nuclear fuel (SNF) and high-level radioactive waste (HLW) in a manner that protects public health, safety, and the environment; enhances national and energy security; and merits public confidence.

Yucca Mountain Repository Project

The President identified the Yucca Mountain Project in the Terminations and Reductions section of the fiscal year (FY) 2010 Congressional Budget Request submitted to Congress in May 2009. Since that time, the Department of Energy has been evaluating a range of options for bringing the project to an orderly close. In FY 2010, the Department of Energy will withdraw from consideration by the Nuclear Regulatory Commission the license application for construction of a geologic repository at Yucca Mountain, Nevada, in accordance with applicable regulatory requirements.

In FY 2010, the Office of Civilian Radioactive Waste Management will prepare the Yucca Mountain site for stewardship and remediation. The Department will work closely with state and federal agencies to develop and implement a remediation plan for the site that adheres to all applicable statutes and regulations. The Office of Environmental Management (EM) staff will support remediation planning for the Yucca Mountain repository site.

Per the Office of Nuclear Energy's FY 2011 budget request, that organization will develop and execute a research and development program that will address critical scientific and technical issues associated with the long-term management and disposal of used nuclear fuel. The Office of Nuclear Energy will support the work of the Blue Ribbon Commission and the development of an integrated approach to waste management options.

Transportation

Transportation planning and procurement activities were ceased in FY 2009.

Program Direction and Management

The Office of Civilian Radioactive Waste Management will also be eliminated in FY 2010. Critical functions under the Nuclear Waste Policy Act, including management of the Standard Contract with utilities and administration of the Nuclear Waste Fund will be the responsibility of the Office of Nuclear Energy. The Department is committed to preserving core scientific knowledge and expertise resident in government and national laboratory personnel and applying it to developing a different approach to used fuel management. The Department will make every effort to utilize the expertise and experience of current Office of Civilian Radioactive Waste Management personnel, consistent with federal statutes, regulations, and union agreements.

Facilities Maintenance and Repair

The FY 2011 maintenance and repair budget request reflects the termination of the program.

Direct-Funded Maintenance and Repair

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Repository Project	1,360	900	0
Total, Direct-Funded Maintenance and Repair	1,360	900	0

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
NNSA Service Center			
Program Direction	1,000	500	0
Total, NNSA Service Center	1,000	500	0
Oak Ridge National Laboratory			
Program Direction	0	500	0
Total, Oak Ridge National Laboratory	0	500	0
Sandia National Laboratory			
Repository Project	47,000	40,000	0
Total, Sandia National Laboratory	47,000	40,000	0
Washington Headquarters			
Program Direction	44,590	50,000	0
Program Management and Integration	11,700	4,500	0
Repository Project	14,855	10,200	0
Transportation System	1,000	0	0
Total, Washington Headquarters	72,145	64,700	0
Repository Project Office			
Program Direction	29,393	19,000	0
Program Management and Integration	14,500	6,200	0
Repository Project	123,252	65,900	0
Transportation	1,100	0	0
Total, Repository Project Office	168,245	91,100	0
Total, Nuclear Waste Disposal and Defense Nuclear Waste Disposal	288,390	196,800	0

Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
NNSA Service Center			
Program Direction	1,000	500	0
Total, NNSA Service Center	1,000	500	0
Oak Ridge National Laboratory			
Program Direction	0	500	0
Total, Oak Ridge National Laboratory	0	500	0
Washington Headquarters			
Program Direction	44,590	50,000	0
Program Management and Integration	11,700	4,500	0
Repository Project	14,855	10,200	0
Transportation Project	1,000	0	0
Total, Washington Headquarters	72,145	64,700	0
Repository Project Office			
Program Direction	29,393	19,000	0
Program Management and Integration	14,500	6,200	0
Repository Project	27,252	7,500	0
Transportation Project	1,100	0	0
Total, Repository Project Office	72,245	32,700	0
Total, Nuclear Waste Disposal	145,390	98,400	0

Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Funding by Site by Program

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Sandia National Laboratory			
Repository Project	47,000	40,000	0
Total, Sandia National Laboratory	47,000	40,000	0
Repository Project Office			
Repository Project	96,000	58,400	0
Total, Repository Project Office	96,000	58,400	0
Total, Defense Nuclear Waste Disposal	143,000	98,400	0

Major Changes or Shifts by Site

In FY 2011, there is no work at OCRWM-related sites due to the termination of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management.

Site Description

Oak Ridge National Laboratory
In support of the Yucca Mountain Project and the OCRWM Program Direction budget element, the Oak Ridge Office administered disbursement of funds and contracts/agreements with the OCRWM Management and Operations (M&O) contractor, support services contracts and all other financial/contract agreements associated directly with the OCRWM Program.

No funds are provided in FY 2011.

Sandia National Laboratory
The Sandia National Laboratories-New Mexico (SNL) site located in Albuquerque, New Mexico, is a research and development facility and has been the lead laboratory supporting the Yucca Mountain Project.

Funding to SNL is eliminated due to the termination of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management. Follow on work to explore waste management and disposal alternatives to the Yucca Mountain repository will be supported by the Office of Nuclear Energy.

Repository Project Office in Nevada
No funding will be provided for the Yucca Mountain Repository Project in Las Vegas, Nevada. Leases will be cancelled in FY 2010.

Nuclear Waste Disposal and Defense Nuclear Waste Disposal
Office of Civilian Radioactive Waste Management (OCRWM)

Repository Program

Funding Profile by Subprogram

	FY 2009 Current Appropriation	FY 2010 Current Recovery Act Appropriation	FY 2010 Request	FY 2011 Request
Repository Program				
Repository Project	183,252	0	116,100	0
Transportation	2,100	0	0	0
Program Management & Integration	26,200	0	10,700	0
Congressionally Directed Projects	1,855	0	0	0
Subtotal, Repository Program	213,407	0	126,800	0
Program Direction	74,983	0	70,000	0
Total, Repository Program	288,390	0	196,800	0

Repository Project

Funding Schedule by Activity

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Repository Project			
License	73,000	86,500	0
Safety Analysis	53,478	0	0
Balance of Plant Infrastructure	4,207	2,000	0
Project Support	52,567	27,600	0
Total, Repository Project	183,252	116,100	0

Mission

The mission of the Office of Civilian Radioactive Waste Management (OCRWM) was to manage and dispose of Spent Nuclear Fuel (SNF) and High Level Radioactive Waste (HLW) in a manner that protects public health and safety and the environment; enhances national security; and merits public confidence.

Repository Project

With the FY 2010 President's Budget Request, the Administration announced the termination of the Yucca Mountain Project. All funding for Project has been eliminated due to the withdrawal of the License Application. The Yucca Mountain Project and the Office of Civilian Radioactive Waste Management will be terminated by the end of FY 2010.

The Yucca Mountain site occupies part of the Nevada Test Site as well as lands managed by the Bureau of Land Management (BLM) and the United States Air Force. DOE will engage BLM, the Air Force, and the State of Nevada, which has regulatory authority over certain aspects of the site, to determine the appropriate level of remediation necessary at the site. The Office of Environmental Management will support remediation planning.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Licensing Support	**73,000**	**86,500**	**0**

In FY 2010, the Department of Energy will withdraw from consideration by the Nuclear Regulatory Commission the license application for construction of a geologic repository at Yucca Mountain, Nevada, in accordance with applicable regulatory requirements. The Department will conduct lease cancellation, contract termination, preservation and archiving of project records, and any necessary personnel separation activities.

	FY 2009	FY 2010	FY 2011
Safety Analyses and Assessments	**53,478**	**0**	**0**

Safety Analyses and Assessments work ended in FY 2009 with the transition from technical evaluation of the license application to administrative hearings.

	FY 2009	FY 2010	FY 2011
Balance of Plant Infrastructure	**4,207**	**2,000**	**0**

Design work associated with development of the geologic repository at Yucca Mountain will be cancelled in 2010. Remaining funds in this area will be dedicated to preparing the repository site for stewardship and remediation.

	FY 2009	FY 2010	FY 2011
Project Support	**49,667**	**27,600**	**0**

Financial Assistance:

The Department is meeting its obligation for financial assistance in FY 2010. No funding is requested in FY 2011 due to termination of the Yucca Mountain Project.

	FY 2009	FY 2010	FY 2011
Total, Repository Project	**183,252**	**116,100**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
License The decrease is due to the withdrawal of the License Application and the termination of the Yucca Mountain Project.	-86,500
Balance of Plant Infrastructure The decrease is due to the withdrawal of the License Application and the termination of the Yucca Mountain Project.	-2,000
Project Support The decrease is due to the withdrawal of the License Application and the termination of the Yucca Mountain Project.	-27,600
Total Funding Change, Repository Project	**-116,100**

Transportation

Funding Schedule by Activity

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Transportation			
National Transportation			
Intitutional Planning, Policy and Analysis	0	0	0
Stakeholder Relations	0	0	0
180(c) Grants	0	0	0
Nat'l Trans Institutional	1,100	0	0
Corporate Management	0	0	0
Nat'l Trans Management	1,000	0	0
Total National Transportation	2,100	0	0
Nevada Transportation			
Nevada Rail	0	0	0
National Environmental Policy Act (NEPA)	0	0	0
Total Nevada Transportation	0	0	0
Total Transportation	2,100	0	0

Description
The mission of the transportation program was to develop and manage a safe, secure, and efficient transportation system for shipping Spent Nuclear Fuel (SNF) and High-Level Waste (HLW) from locations throughout the United States to a location for effective management and disposal.

National Transportation
In FY 2011, there will be no activities due to the termination of the Office of Civilian Radioactive Waste Management.

Nevada Transportation
In FY 2011, there will be no activities due to the termination of the Office of Civilian Radioactive Waste Management.

Detailed Justification

	(dollars in thousands) FY 2009	FY 2010	FY 2011
National Transportation No funding is requested for activities within this budget element in FY 2011.			
▪ **National Transportation Institutional**	**1,100**	**0**	**0**
▪ **National Transportation Management**	**1,000**	**0**	**0**
Total, National Transportation	**2,100**	**0**	**0**
Nevada Transportation No funding is requested for activities within this budget element in FY 2011.			
▪ **Nevada Rail**	**0**	**0**	**0**
▪ **Nevada Rail Environmental Impact Statement (EIS)**	**0**	**0**	**0**
Total, Nevada Transportation	**0**	**0**	**0**
Total, Transportation	**2,100**	**0**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
National Transportation	0
Nevada Transportation	0
Total Funding Change, Transportation	**0**

Program Management and Integration

Funding Schedule by Activity

	FY 2009	FY 2010	FY 2011
	(dollars in thousands)		
Quality Assurance	10,000	6,970	0
Program Management			
Program Management and Control	500	30	0
Information Management	4,000	0	0
Human Resources and Education	500	500	0
Total, Program Management	5,000	530	0
Safeguards and Security	5,000	3,000	0
Waste Acceptance	4,000	0	0
System Analysis and Strategy Development			
Fee Adequacy Assessment	200	200	0
System Configuration Management	0	0	0
Total, System Analysis and Strategy Development	200	200	0
Science and Technology, and International			
International Program and Coordination	2,000	0	0
Science and Technology, and International	0	0	0
Total, Science and Technology and International	2,000	0	0
Total, Program Management & Integration	26,200	10,700	0

Description

All Program Management and Integration activities will cease due to the planned elimination of the Office of Civilian Radioactive Waste Management. Ongoing responsibilities under the Nuclear Waste Policy Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of Nuclear Energy, which will lead future waste management activities.

Contracts for goods and services with the Office of Civilian Radioactive Waste Management will be terminated, excluding the Standard Contract for disposal services with utilities. Current contracts include the management and operations contract for the repository, quality assurance support services, management and technical support services, information technology services, document and records management, security services, administrative services, and legal services. Many of these contracts will require advance notice of termination during which costs incurred will be reimbursed. Further, DOE is responsible for the costs associated with the management and operations contractor's defined benefit pension plan; upon program termination, the Department will fulfill its responsibilities and ensure that current and future retirees receive their benefits in accordance with the plan.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Quality Assurance	**10,000**	**6,970**	**0**

All funding for Quality Assurance has been eliminated due to the withdrawal of the License Application and the termination of the Yucca Mountain Project.

	FY 2009	FY 2010	FY 2011
Program Management	**5,000**	**530**	**0**

All funding for Program Management has been eliminated due to the withdrawal of the License Application, termination of the Yucca Mountain Project, and termination of the Office of Civilian Radioactive Waste Management.

	FY 2009	FY 2010	FY 2011
▪ **Program Management and Control**	**500**	**30**	**0**

All funding for Program Management and Control has been eliminated due to the withdrawal of the License Application, termination of the Yucca Mountain Project, and termination of the Office of Civilian Radioactive Waste Management.

	FY 2009	FY 2010	FY 2011
▪ **Information Management**	**4,000**	**0**	**0**
▪ **Human Resources and Education**	**500**	**500**	**0**

All funding for Human Resources has been eliminated due to the termination of the Office of Civilian Radioactive Waste Management.

	FY 2009	FY 2010	FY 2011
Total Program Management	**5,000**	**530**	**0**
Safeguards and Security	**5,000**	**3,000**	**0**

All funding for Safeguards and Security has been eliminated due to the withdrawal of the License Application, termination of the Yucca Mountain Project, and termination of the Office of Civilian Radioactive Waste Management.

	FY 2009	FY 2010	FY 2011
Waste Acceptance	**4,000**	**0**	**0**

Other DOE offices will continue to support the implementation of the Standard Disposal Contract and any amendments; negotiating and implementing new reactor waste disposal contracts for the new generation of nuclear reactors; validate and disseminate SNF discharge/storage data; review and validate fee payments; negotiate and implement settlements of litigation relating the delay in beginning waste acceptance; and negotiate and implement modifications to individual contracts that are beneficial to the Government and the individual utility (Purchaser).

In addition to supporting the settlement negotiations and review process, the Department will continue to provide support to the Department of Justice for litigation through the collection of large volumes of discovery materials and will continue to provide depositions and testimony.

	FY 2009	FY 2010	FY 2011
System Analysis and Strategy Development	**200**	**200**	**0**

▪ **Fee Adequacy Assessment**	**200**	**200**	**0**

The functions for the Fee Adequacy Assessment efforts will be transferred from the Office of Civilian Radioactive Waste Management to support future plans within the Department to implement the Nuclear Waste Policy Act.

▪ **System Configuration Management**	**0**	**0**	**0**
Total, System Analysis and Strategy Development	**200**	**200**	**0**

The functions for the System Analysis efforts will be transferred from the Office of Civilian Radioactive Waste Management to support future plans within the Department to implement the Nuclear Waste Policy Act.

Science and Technology, and International	**2,000**	**0**	**0**

All funding for Science and Technology, and International has been eliminated due to termination of the Office of Civilian Radioactive Waste Management. International activities related to the management and disposition of spent nuclear fuel and high level radioactive waste will be supported by the Office of Nuclear Energy.

▪ **International Program and Coordination**	**2,000**	**0**	**0**
▪ **Science and Technology**	**0**	**0**	**0**
Total, Science and Technology, and International	**2,000**	**0**	**0**
Total Program Management & Integration	**26,200**	**10,700**	**0**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Quality Assurance The decrease is due to the withdrawal of the License Application and the termination of the Yucca Mountain Project.	-6,970
Program Management The decrease is due to the withdrawal of the License Application and the termination of the Office of Civilian Radioactive Waste Management.	-530
Safeguards and Security The decrease is due to the termination of the termination of the Repository Project and the Office of Civilian Radioactive Waste Management.	-3,000
Total Funding Change, Program Management and Integration	**-10,700**

Program Direction
Funding Profile by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Office of Repository Development			
Salaries and Benefits	25,066	26,883	0
Travel	800	685	0
Information Technology	8,900	8,700	0
Support Services	4,540	3,500	0
Other Related Expenses	1,810	1,810	0
Total, Office of Repository Development	41,116	41,578	0
Full-Time Equivalents	175	175	0
Service Center Support			
Salaries and Benefits	1,000	1,000	0
Total, Service Center Support	1,000	1,000	0
Full-Time Equivalents	3	3	0
Headquarters			
Management & Operational Support			
Salaries and Benefits	14,844	14,617	0
Travel	700	300	0
Information Technology	3,800	3,800	0
Support Services	6,433	2,600	0
Other Related Expenses	190	190	0
Working Capital Fund	2,500	2,500	0
	28,467	24,007	0
Other Matrix Support			
Salaries and Benefits	4,375	3,400	0
Travel	25	15	0
Total, Headquarters	32,867	27,422	0
Full-Time Equivalents	118	118	0
Total, Program Direction	74,983	70,000	0
Full-Time Equivalents	296	296	0

Description

The Administration has determined that developing the Yucca Mountain repository is not a workable option and that the Nation needs a different solution for nuclear waste disposal. The Office of Civilian Radioactive Waste Management will be terminated. The core functions and staff to support efforts under the Nuclear Waste Policy Act to meet the obligations of the Government will continue under the Office of Nuclear Energy, which will lead all future waste management activities. Every effort will be made to utilize the expertise and experience of Office of Civilian Radioactive Waste Management personnel in other Departmental organizations or government agencies consistent with Title 5 of the United States Code, Civil Service Regulations, and union agreements.

Detailed Justification

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Salaries and Benefits	45,285	45,900	0
Travel	1,525	1,000	0
Information Technology	12,700	12,500	0
Support Services	10,973	6,100	0
Other Related Expenses	2,000	2,000	0
Working Capital Fund	2,500	2,500	0
Total, Program Direction	74,983	70,000	0

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Salaries and Benefits The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-45,900
Travel The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-1,000
Information Technology The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-12,500
Support Services The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-6,100
Other Related Expenses The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-2,000
Working Capital Fund The decrease is due to the termination of the Office of Civilian Radioactive Waste Management.	-2,500
Total Funding Changes, Program Direction	**-70,000**

Support Services by Category

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Technical Support			
Repository Project			
Management and Technical Services	9,268	4,400	0
Administrative Services	1,400	1,395	0
Total, Repository Project	10,668	5,795	0
System Analysis and Strategic Development			
System Engineering	0	0	0
System Analysis	0	0	0
Waste Acceptance	0	0	0
Regulatory Coordination	0	0	0
Total, System Analysis & Strategic Development	0	0	0
Total, Technical Support	10,668	5,795	0
Management Support			
Program Management & Integration			
Quality Assurance	300	300	0
Program Management & Control			
Program Management, Planning & Control	5	5	0
Audits and Reports	0	0	0
Baseline Management	0	0	0
Program & Policy Integration	0	0	0
Public Information	0	0	0
Total, Program Management & Control	5	5	0
Total, Program Management & Integration	305	305	0
Total, Management Support	305	305	0
Total, Support Services	10,973	6,100	0

Other Related Expenses by Category (Including Working Capital Fund)

(dollars in thousands)

	FY 2009	FY 2010	FY 2011
Other Related Expenses			
Repository Project			
Communication, Other Rent, and Utilities	1,660	1,660	0
Other Services	90	90	0
Human Resources & Administration	60	60	0
Total, Repository Project	1,810	1,810	0
Headquarters			
Other Services	40	40	0
Human Resources & Administration	30	30	0
Supplies and Materials	20	20	0
Services Performed by Other Agencies	100	100	0
Working Capital Fund	2,500	2,500	0
Total, Headquarters	2,690	2,690	0
Total, Other Related Expenses	4,500	4,500	0

Congressionally Directed Projects

Funding Profile by Subprogram

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Congressionally Directed Projects	1,855	0	0

Description
OCRWM has no Congressionally Directed Projects for FY 2010 or FY 2011.

Detailed Justification

	(dollars in thousands)		
	FY 2009	FY 2010	FY 2011
Congressionally Directed Projects			
▪ Cooperative Agreement between the Department of Energy and Inyo County (CA)	1,522	0	0
▪ Inyo County Affected Unit of Local Government (CA)	333	0	0
Total, Program Direction	1,855	0	0

GENERAL PROVISIONS

[SEC. 301. None of the funds appropriated by this Act may be used to prepare or initiate Requests For Proposals (RFPs) for a program if the program has not been funded by Congress.]

[SEC. 302. None of the funds appropriated by this Act may be used—

(1) to augment the funds made available for obligation by this Act for severance payments and other benefits and community assistance grants under section 4604 of the Atomic Energy Defense Act (50 U.S.C. 2704) unless the Department of Energy submits a reprogramming request to the appropriate congressional committees; or

(2) to provide enhanced severance payments or other benefits for employees of the Department of Energy under such section; or

(3) develop or implement a workforce restructuring plan that covers employees of the Department of Energy.]

SEC. [303]*301.* The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. [304]*302.* None of the funds in this or any other Act for the Administrator of the Bonneville Power Administration may be used to enter into any agreement to perform energy efficiency services outside the legally defined Bonneville service territory, with the exception of services provided internationally, including services provided on a reimbursable basis, unless the Administrator certifies in advance that such services are not available from private sector businesses.

SEC. [305]*303.* When the Department of Energy makes a user facility available to universities or other potential users, or seeks input from universities or other potential users regarding significant characteristics or equipment in a user facility or a proposed user facility, the Department shall ensure broad public notice of such availability or such need for input to universities and other potential users. When the Department of Energy considers the participation of a university or other potential user as a formal partner in the establishment or operation of a user facility, the Department shall employ full and open competition in selecting such a partner. For purposes of this section, the term "user facility" includes, but is not limited to:

(1) a user facility as described in section 2203(a)(2) of the Energy Policy Act of 1992 (42 U.S.C. 13503(a)(2));

(2) a National Nuclear Security Administration Defense Programs Technology Deployment Center/User Facility; and

(3) any other Departmental facility designated by the Department as a user facility.

SEC. [306]*304.* Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 414) during fiscal year [2010] *2011* until the enactment of the Intelligence Authorization Act for fiscal year [2010] *2011.*

SEC. [307]*305.* Of the funds made available by the Department of Energy for activities at Government-owned, contractor-operated laboratories funded in this Act or subsequent Energy and Water Development Appropriations Acts, the Secretary may authorize a specific amount, not to exceed

8 percent of such funds, to be used by such laboratories for laboratory directed research and development: *Provided*, That the Secretary may also authorize a specific amount not to exceed 4 percent of such funds, to be used by the plant manager of a covered nuclear weapons production plant or the manager of the Nevada Site Office for plant or site directed research and development.

SEC. [308]*306*. (a) In any fiscal year in which the Secretary of Energy determines that additional funds are needed to reimburse the costs of defined benefit pension plans for contractor employees, the Secretary may transfer not more than 1 percent from each appropriation made available in this and subsequent Energy and Water Development Appropriation Acts to any other appropriation available to the Secretary in the same Act for such reimbursements.

[(b) Where the Secretary recovers the costs of defined benefit pension plans for contractor employees through charges for the indirect costs of research and activities at facilities of the Department of Energy, if the indirect costs attributable to defined benefit pension plan costs in a fiscal year are more than charges in fiscal year 2008, the Secretary shall carry out a transfer of funds under this section.]

([c]*b*) In carrying out a transfer under this section, the Secretary shall use each appropriation made available to the Department in that fiscal year as a source or the transfer, and shall reduce each appropriation by an equal percentage, except that appropriations for which the Secretary determines there exists a need for additional funds for pension plan costs in that fiscal year, as well as appropriations made available for the Power Marketing Administrations, the title XVII loan guarantee program, and the Federal Energy Regulatory Commission, shall not be subject to this requirement.

([d]*c*) Each January, the Secretary shall report to the Committees on Appropriations of the House of Representatives and the Senate on the state of defined benefit pension plan liabilities in the Department for the preceding year.

([e]*d*) This transfer authority does not apply to supplemental appropriations, and is in addition to any other transfer authority provided in this or any other Act. The authority provided under this section shall expire on September 30, 2015.

([f]*e*) The Secretary shall notify the Committees on Appropriations of the House of Representatives and the Senate in writing not less than 30 days in advance of each transfer authorized by this section.

[SEC. 309. (a) Subject to subsection (b), no funds appropriated or otherwise made available by this Act or any other Act may be used to record transactions relating to the increase in borrowing authority or bonds outstanding at any time under the Federal Columbia River Transmission System Act (16 U.S.C. 838 et seq.) referred to in section 401 of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 140) under a funding account, subaccount, or fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol.

(b) Funds appropriated or otherwise made available by this Act or any other Act may be used to ensure, for purposes of meeting any applicable reporting provisions of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 123 Stat. 115), that the Bonneville Power Administration uses a fund symbol other than the Bonneville Power Administration Fund Treasury account fund symbol solely to report accrued expenditures of projects attributed by the Administrator of the Bonneville Power Administration to the increased borrowing authority.

(c) This section is effective for fiscal year 2010 and subsequent fiscal years.]

[SEC. 310. Section 1702 of the Energy Policy Act of 2005 (42 U.S.C. 16512) is amended by adding at the end the following new subsection:

"(k) WAGE RATE REQUIREMENTS.—All laborers and mechanics employed by contractors and subcontractors in the performance of construction work financed in whole or in part by a loan guaranteed under this title shall be paid wages at rates not less than those prevailing on projects of a character similar in the locality as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, United States Code. With respect to the labor standards in this subsection, the Secretary of Labor shall have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (64 Stat. 1267; 5 U.S.C. App.) and section 3145 of title 40, United States Code.".]

[SEC. 311. None of the funds made available by this Act may be used to make a grant allocation, discretionary grant award, discretionary contract award, Other Transaction Agreement, or to issue a letter of intent totaling in excess of $1,000,000, or to announce publicly the intention to make such an award, including a contract covered by the Federal Acquisition Regulation, unless the Secretary of Energy notifies the Committees on Appropriations of the Senate and the House of Representatives at least 3 full business days in advance of making such an award or issuing such a letter: *Provided*, That if the Secretary of the Department of Energy determines that compliance with this section would pose a substantial risk to human life, health, or safety, an award may be made without notification and the Committees on Appropriations of the Senate and the House of Representatives shall be notified not later than 5 full business days after such an award is made or letter issued.]

[SEC. 312. (a) ULTRA EFFICIENT VEHICLES.—Section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) is amended—
(1) in subsection (a)—
(A) in paragraph (1), by inserting "an ultra efficient vehicle or" after "means"; and
(B) by adding at the end the following new paragraph:
"(5) ULTRA EFFICIENT VEHICLE.—The term 'ultra efficient vehicle' means a fully closed compartment vehicle designed to carry at least 2 adult passengers that achieves—
"(A) at least 75 miles per gallon while operating on gasoline or diesel fuel;
"(B) at least 75 miles per gallon equivalent while operating as a hybrid electric-gasoline or electric-diesel vehicle; or
"(C) at least 75 miles per gallon equivalent while operating as a fully electric vehicle.";
(2) in subsection (b)—
(A) by inserting ", ultra efficient vehicle manufacturers," after "automobile manufacturers";
(B) in paragraph (1)—
(i) by striking "or" at the end of subparagraph (A);
(ii) by striking "and" at the end of subparagraph (B) and inserting "or"; and
(iii) by adding at the end the following new subparagraph:
"(C) ultra efficient vehicles; and"; and
(C) in paragraph (2), by inserting ", ultra efficient vehicles," after "qualifying vehicles";
(3) in subsection (g), by inserting "or are utilized primarily for the manufacture of ultra efficient vehicles" after "20 years"; and
(4) in subsection (h)(1)(B), by striking "automobiles" the first place it appears and inserting "ultra efficient vehicles, automobiles,".
(b) RECONSIDERATION OF PRIOR APPLICATIONS.—The Secretary of Energy shall reconsider applications for assistance under section 136 of the Energy Independence and Security Act of 2007 (42 U.S.C. 17013) that were—
(1) timely filed under that section before January 1, 2009;
(2) rejected on the basis that the vehicles to which the proposal related were not advanced technology vehicles; and
(3) related to ultra efficient vehicles.]

[SEC. 313. (a) Except as provided in subsection (b), none of the funds appropriated or otherwise made available by this title for the Strategic Petroleum Reserve may be made available to any person that as of the enactment of this Act—

(1) is selling refined petroleum products valued at $1,000,000 or more to the Islamic Republic of Iran;

(2) is engaged in an activity valued at $1,000,000 or more that could contribute to enhancing the ability of the Islamic Republic of Iran to import refined petroleum products, including—

(A) providing ships or shipping services to deliver refined petroleum products to the Islamic Republic of Iran;

(B) underwriting or otherwise providing insurance or reinsurance for such an activity; or

(C) financing or brokering such an activity; or

(3) is selling, leasing, or otherwise providing to the Islamic Republic of Iran any goods, services, or technology valued at $1,000,000 or more that could contribute to the maintenance or expansion of the capacity of the Islamic Republic of Iran to produce refined petroleum products.

(b) The prohibition on the use of funds under subsection (a) shall not apply with respect to any contract entered into by the United States Government before the date of the enactment of this Act.

(c) If the Secretary determines a person made ineligible by this section has ceased the activities enumerated in (a)(1)-(3), that person shall no longer be ineligible under this section.]

[SEC. 314. Section 132 of the Energy and Water Development Appropriations Act of 2006 (119 Stat 2261) is amended—

(1) in subsection (a)(3), by striking "Corps of Engineers" and inserting "Southwestern Power Administration";

(2) by adding at the end of subsection (a) the following new paragraph:

"(5) PAYMENT TO NON-FEDERAL LICENSEE.—Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 pursuant to paragraph (3) using receipts collected from the sale of Federal power and energy related services. Pursuant to paragraph (6), Southwestern Power Administration will begin collecting receipts in the Special Receipts and Disbursement account upon the date of enactment of this paragraph. Payment to the licensee of Federal Energy Regulatory Commission Project No. 2221 shall be paid as soon as adequate receipts are collected in the Special Receipts and Disbursement Account to fully compensate the licensee, and in accordance with paragraph (2), such payment shall be considered non-reimbursable.";

(3) by adding at the end of subsection (a) the following new paragraph:

"(6) The Southwestern Power Administration shall compensate the licensee of Federal Energy Regulatory Commission Project No. 2221 in annual payments of not less than $5,000,000, until the licensee of Federal Energy Regulatory Commission Project No. 2221 is fully compensated pursuant to paragraph (3). At the end of each fiscal year subsequent to implementation, any remaining balance to be paid to the licensee of Project No. 2221 shall accrue interest at the 30-year U.S. Treasury bond rate in effect at the time of implementation of the White River Minimum Flows project.";

(4) by adding at the end of subsection (a) the following new paragraph:

"(7) ESTABLISHMENT OF SPECIAL RECEIPT AND DISBURSEMENT ACCOUNTS.—There is established in the Treasury of the United States a special receipt account and corresponding disbursement account to be made available to the Administrator of the Southwestern Power Administration to disburse pre-collected receipts from the sale of federal power and energy and related services. The accounts are authorized for the following uses:

"(A) Collect and disburse receipts for purchase power and wheeling expenses incurred by Southwestern Power Administration to purchase replacement power and energy as a result of implementation of the White River Minimum Flows project.

"(B) Collect and disburse receipts related to compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221.

"(C) Said special receipt and disbursement account shall remain available for not more than 12 months after the date of full compensation of the licensee of Federal Energy Regulatory Commission Project No. 2221."; and

(5) by adding at the end of subsection (a) the following new paragraph:

"(8) TIME OF IMPLEMENTATION.—For purposes of paragraphs (3) and (4), `time of implementation' shall mean the authorization of the special receipt account and corresponding disbursement account described in paragraph (7).".]

SEC. 307. (a) Section 1801 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g) is amended in subsection (b)(2) by striking "amounts contained within the Fund" and inserting "assessments collected pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) as amended".

(b) Section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1) is amended:

(1) in subsection (a):

(A) by striking *"$518,233,333" and inserting "$663,000,000"; and*

(B) by striking *"on October 24, 1992" and inserting "with fiscal year 2012".*

(2) in subsection (c):

(A) by inserting *"(1)" before "The Secretary";*

(B) by inserting *after "utilities": ", only to the extent provided in advance in appropriation Acts";*

(C) by striking "$150,000,000" and inserting "$200,000,000";

(D) by inserting *"beginning in fiscal year 2012" after "adjusted for inflation";*

(E) by striking "(1)" and inserting "(A)";

(F) by striking "(2)" and inserting "(B)";

(G) by adding a new paragraph 2, ",(2) Amounts authorized to be collected pursuant to this section shall be deposited in the Fund and credited as offsetting receipts."

(3) in subsection (d), by striking "for the period encompassing 15 years after the date of the enactment of this title" and inserting "through fiscal year 2026"; and

(4) in subsection (e):

(A) in paragraph (1), by striking "15 years after the date of the enactment of this title" and inserting "September 30, 2026";

(B) in *paragraph (2), by striking "$2,250,000,000" and inserting "$3,000,000,000"; and*

(C) in *paragraph (2) by inserting "beginning in fiscal year 2012" after "adjusted for inflation".*

SEC. 308. The Secretary shall collect up to $200,000,000 in assessments pursuant to section 1802 of the Atomic Energy Act of 1954 (42 U.S.C. 2297g-1), as amended by this Act.

SEC. 309. For an additional amount for the "Other Defense Activities" account, $11,891,755, to increase the Department's acquisition workforce capacity and capabilities: Provided, That such funds may be transferred by the Secretary to any other account in the Department to carry out the purposes provided herein: Provided further, That such transfer authority is in addition to any other transfer authority provided in this Act: Provided further, That such funds shall be available only to supplement and not to supplant existing acquisition workforce activities: Provided further, That such funds shall be available for training, recruitment, retention, and hiring additional members of the acquisition workforce as defined by the Office of Federal Procurement Policy Act, as amended (41 U.S.C. 401 et *seq.): Provided further, That such funds shall be available for information technology in support of acquisition workforce effectiveness or for management solutions to improve acquisition management.*

SEC. 310. Not to exceed 5 per centum, or $100,000,000, of any appropriation, whichever is less, made available for Department of Energy activities funded in this Act or subsequent Energy and Water Development and Related Agencies Appropriation Acts may hereafter be transferred between such appropriations, but no appropriation, except as otherwise provided, shall be increased or decreased by more that 5 per centum by any such transfers, and any such proposed transfers shall be submitted to the Committee on Appropriations of the House and Senate. (Energy and Water Development and Related Agencies Appropriations Act, 2010.)

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. To the extent practicable funds made available in this Act should be used to purchase light bulbs that are "Energy Star" qualified or have the "Federal Energy Management Program" designation.

[SEC. 503. Title IV of division A of the American Recovery and Reinvestment Act of 2009 (Public Law 111-5) is amended by adding at the end of the title, the following new section 411:

"SEC 411. Up to 0.5 percent of each amount appropriated to the Department of the Army and the Bureau of Reclamation in this title may be used for the expenses of management and oversight of the programs, grants, and activities funded by such appropriation, and may be transferred by the Head of the Federal Agency involved to any other appropriate account within the department for that purpose: *Provided*, That the Secretary will provide a report to the Committees on Appropriations of the House of Representatives and the Senate 30 days prior to the transfer: *Provided further*,That funds set aside under this section shall remain available for obligation until September 30, 2012.".]

[SEC. 504. (a) DEFINITIONS.—In this section:

(1) *ADMINISTRATIVE* EXPENSES.—The term "administrative expenses" has the meaning as determined by the Director under subsection (b)(2).

(2) *AGENCY.*—The term "agency"—

(A) means an agency as defined under section 1101 of title 31, United States Code, that is established in the executive branch and receives funding under this Act; and

(B) shall not include the District of Columbia government.

(3) *DIRECTOR.*—The term "Director" means the Director of the Office of Management and Budget.

(b) ADMINISTRATIVE EXPENSES.—

(1) IN *GENERAL.*—All agencies shall include a separate category for administrative expenses when submitting their appropriation requests to the Office of Management and Budget for fiscal year 2011 and each fiscal year thereafter.

(2) *ADMINISTRATIVE* EXPENSES DETERMINED.—In consultation with the agencies, the Director shall establish and revise as necessary a definition of administration expenses for the purposes of this section. All questions regarding the definition of administrative expenses shall be resolved by the Director.

(c) BUDGET SUBMISSION.—Each budget of the United States Government submitted under section 1105 of title 31, United States Code, for fiscal year 2011 and each fiscal year thereafter shall include the amount requested for each agency for administrative expenses.]

[SEC. 505. None of the funds made available in this Act may be transferred to any department, agency, or instrumentality of the United States Government, except pursuant to a transfer made by, or transfer authority provided in this Act or any other appropriation Act.]

SEC. [506]*503.* [Specific projects contained in] *To the extent that* the report of the Committee on Appropriations of the House of Representatives accompanying this Act [(H. Rept. 111-203)] *includes specific projects* that are considered congressional earmarks for purposes of clause 9 of rule XXI of the Rules of the House of Representatives, *such projects,* when intended to be awarded to a for-profit entity, shall be awarded under a full and open competition. *(Energy and Water Development and Related Agencies Appropriations Act, 2010.)*